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ABN 35 000 689 216

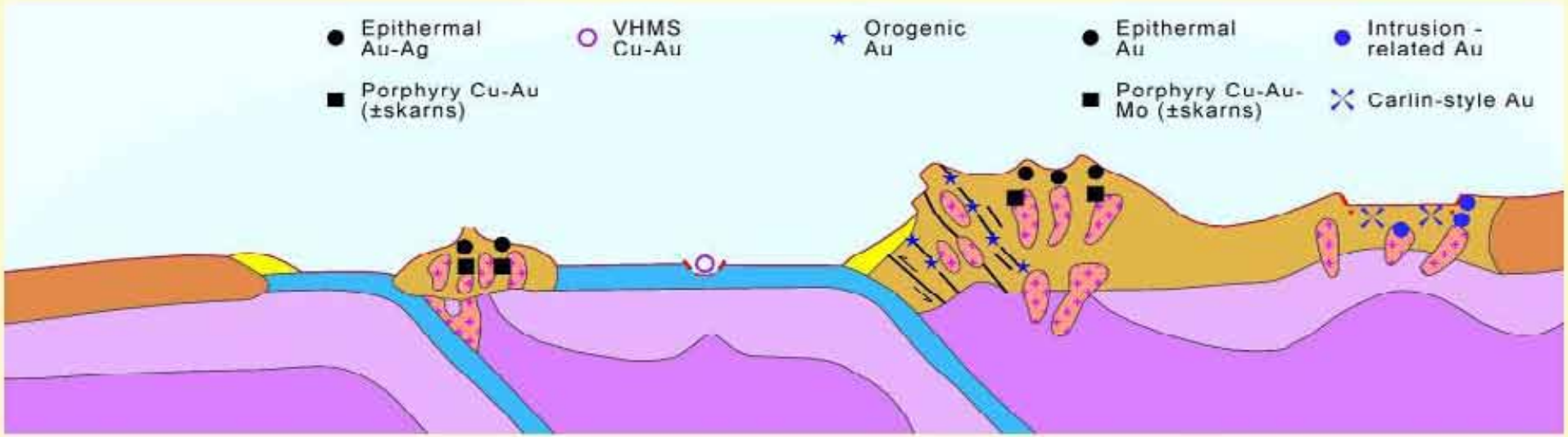
OROGENIC GOLD in the EAST LACHLAN OROGEN

Mines and Wines

Orange September 2007

Ian Chalmers Terry Ransted Dave Meates

Tectonic Settings of Epigenetic Gold Deposits



Tectonic settings of gold-rich epigenetic mineral deposits. Groves et al. 2003

Epigenetic = deposits of later origin than their enclosing rocks

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Orogenic Gold – what do we mean?

The explorationists perspective

- Deposits cover a wide spectrum of depositional environments
- Have previously been referred to as Mesothermal, Lode, Structural but have a group of similar characteristics
- They are the predominant deposits in “metamorphic” terrains and are known from the mid Archean to Tertiary in age
- They range in size and include many “giants” of >8Moz (250t) and numerous “world class” deposits of >3Moz (100t)
- Commonly found within accretionary fore arc settings, with compressional/transpressional tectonics
- Proximal association to crustal scale structures

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Orogenic Gold – some regional generalisations

- STRUCTURE: major crustal dislocations with significant fluid flow capacity
- FLUID SOURCE: can be metamorphic, magmatic, and possibly meteoric
- FLUID CHEMISTRY: near neutral (H_2O-CO_2 ± CH_4); low to mod salinity; temp 200-700^oC; 0.5-5 kbar; Au usually transported as bisulphide complex
- FLUID FOCUS: regional secondary structures, including variation in strike, flexures; clusters of intersecting faults; strike slip duplexing
- COMPETENCY CONTRAST: presence of small rigid bodies in a more ductile sequence
- DEPTH: deposition from near surface to ± 20km

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Orogenic Gold – some local generalisations

- STRUCTURE: complex geometry, affected by local kinematics including competency contrasts. Also stratigraphic traps – domes/antiforms
- HOST ROCK: commonly mafic; iron rich; and also carbonaceous sediments
- MINERALISATION: dominant pyrite, pyrrhotite, arsenopyrite with minor chalcopyrite, galena and sphalerite. Rarer W, Mo, Te, Bi. Gold nearly always late
- ALERATION: sericite; carbonate; quartz – silicification; chlorite; sulphides
- WALL ROCK: typical bleaching from a few centimetres to 10 metres
- ZONATION: chl + alb + CO_2 + $Au(HS)_2$ $\rightarrow$ ser + Fe/Mg carb + sulph + gold

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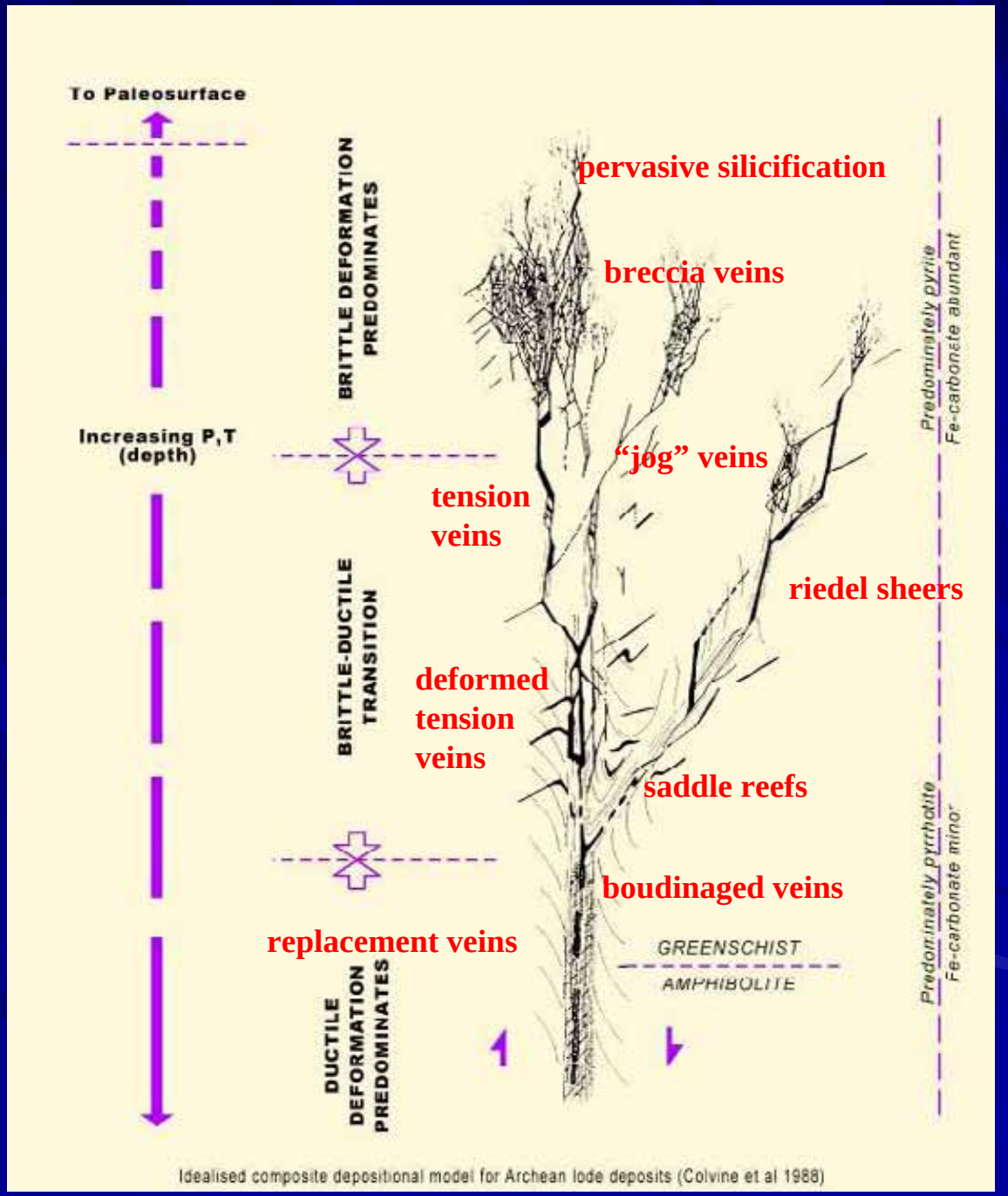
Orogenic Gold Deposits

Idealized composite structural model



Idealised composite depositional model for Archean lode deposits (Colvine et al 1988)

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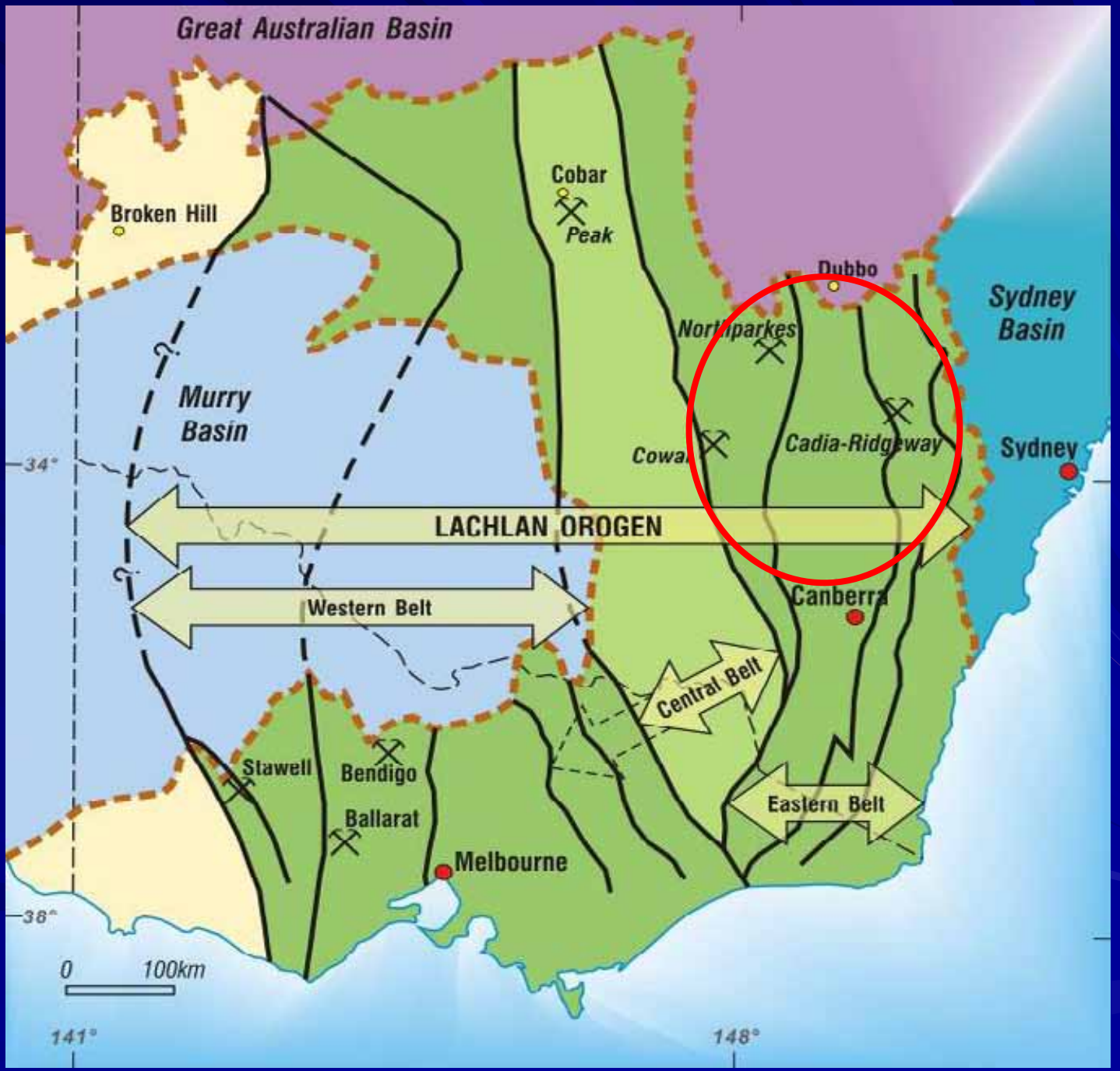
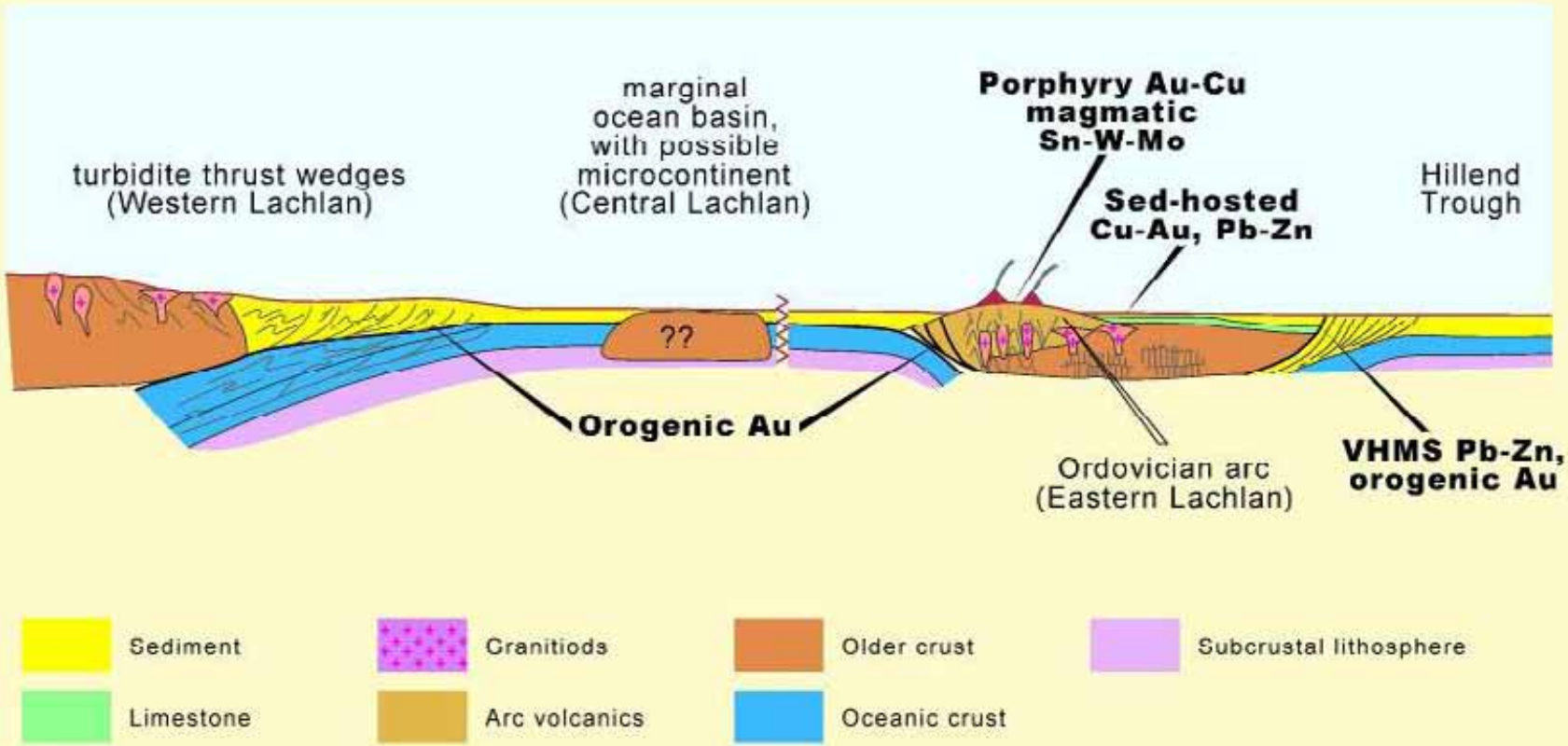
Orogenic Gold Deposits

Structural Divisions of the Lachlan Fold Belt



Diagrammatic View of Tectonic Elements of the Lachlan Orogen



Diagrammatic view of tectonic elements for the Lachlan Orogen. Adapted from Bierlein et al 2002

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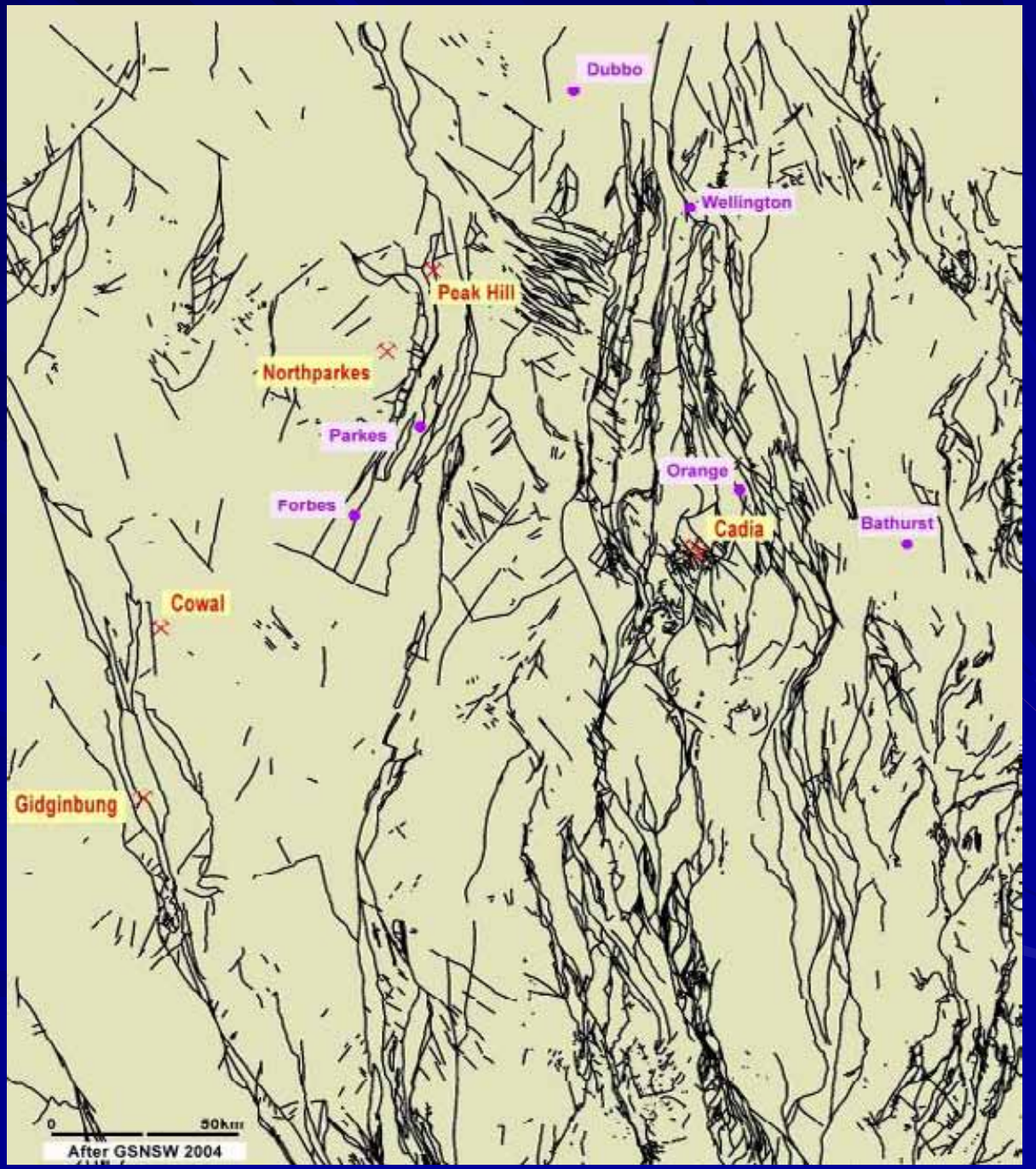
Orogenic Gold Deposits

East Lachlan Fault map



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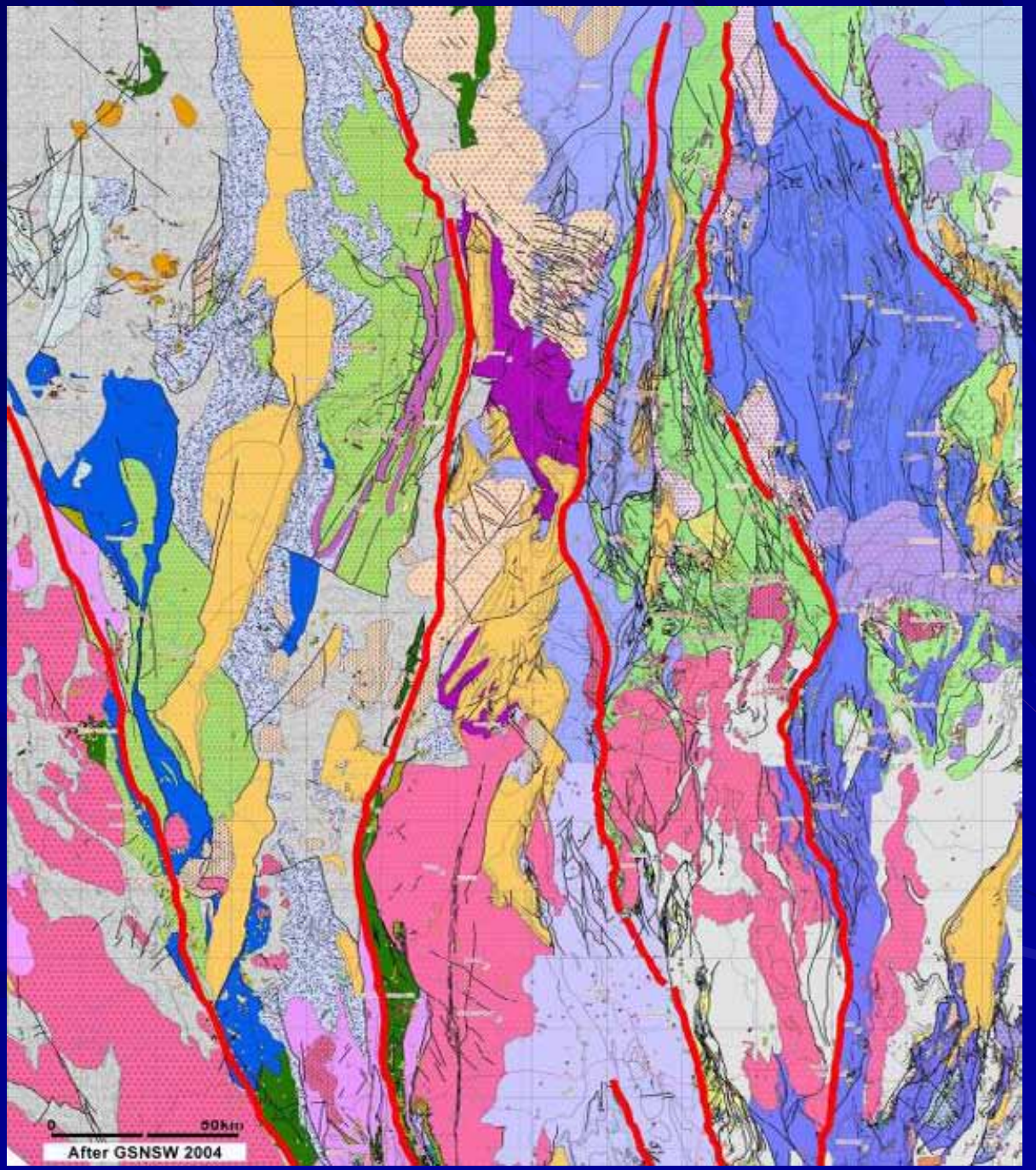
Orogenic
Gold Deposits

East Lachlan Solid Geology

— first order major structures



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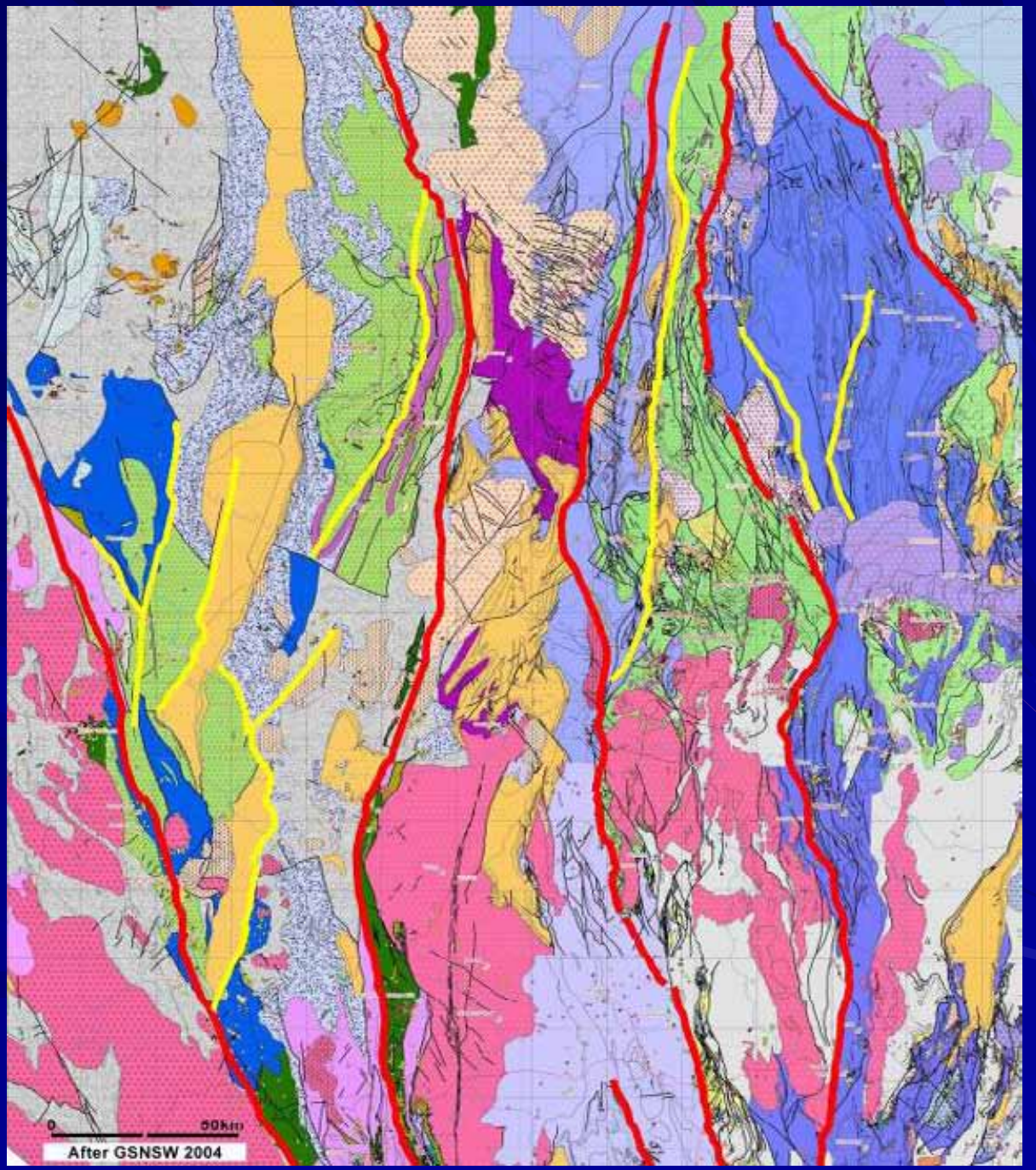
Orogenic Gold Deposits

East Lachlan Solid geology

major structures

second order structures



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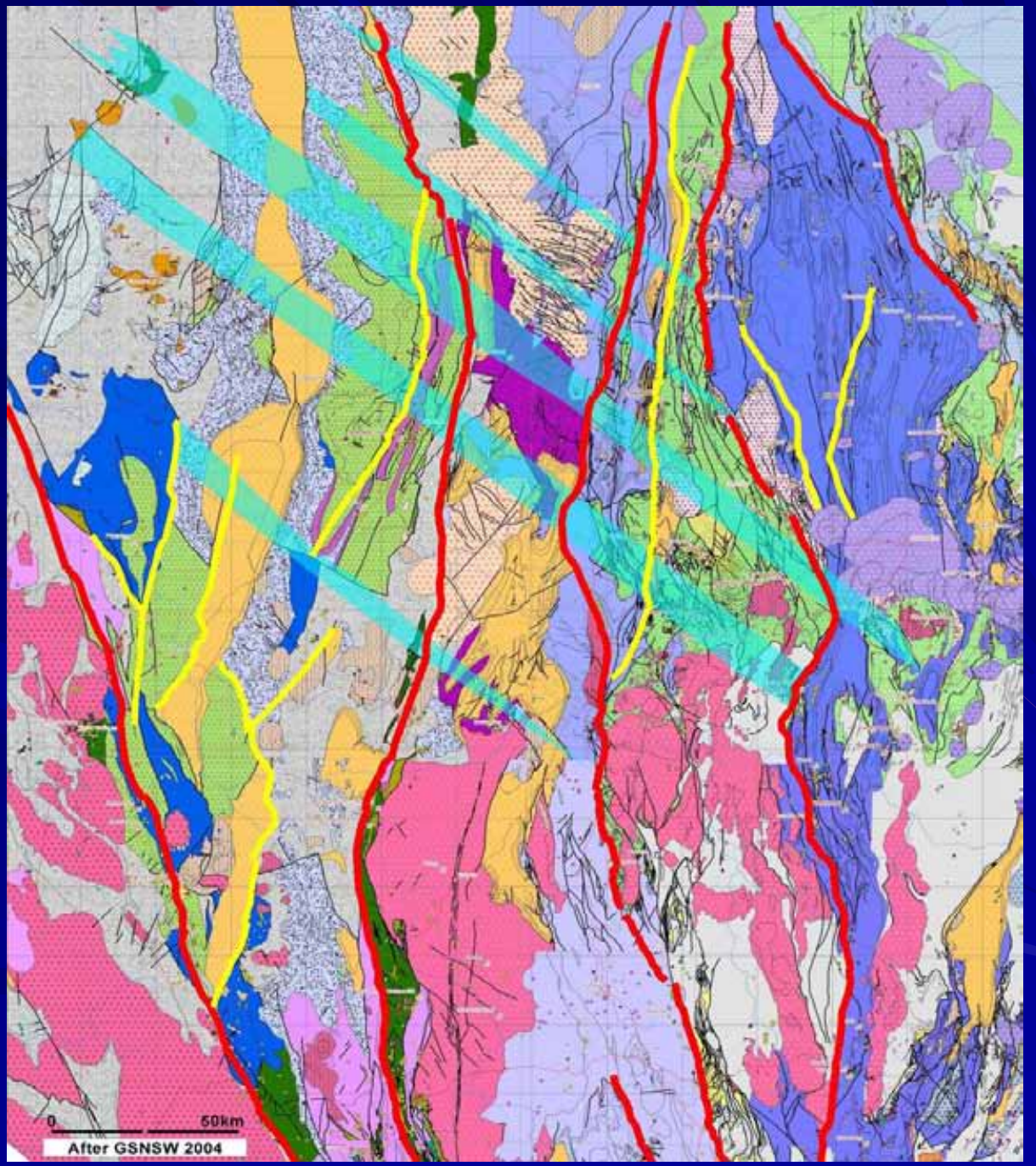
Gold Deposits

East Lachlan solid geology

major structures

second order

northwest corridors



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Orogenic Gold

Are there world class deposits in the East Lachlan?

- Historic production, plus recent output or resources in the region:

Adelong	800,000 oz
Hill End	700,000 oz
Gulgong	540,000 oz
Lucknow	500,000 oz
Parkes	600,000 oz
Young	500,000 oz
West Wyalong	450,000 oz
Forbes	450,000 oz
Bodangora	200,000 oz
Stuart Town	170,000 oz

- New discoveries:

Wyoming	600,000 → 1,000,000 oz
McPhillamys	500,000 → 1,000,000 oz ??

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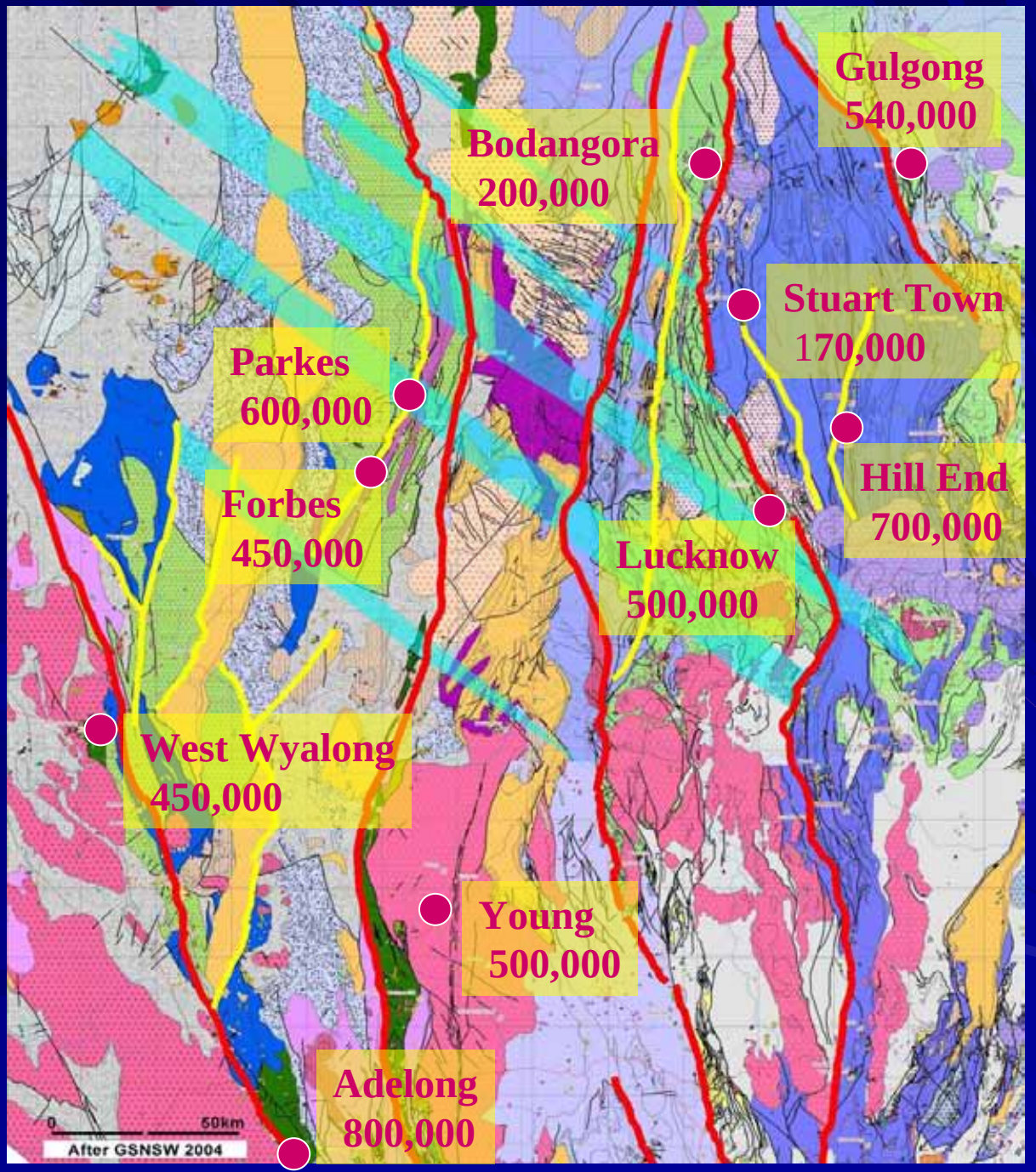
Orogenic Gold Deposits

East Lachlan

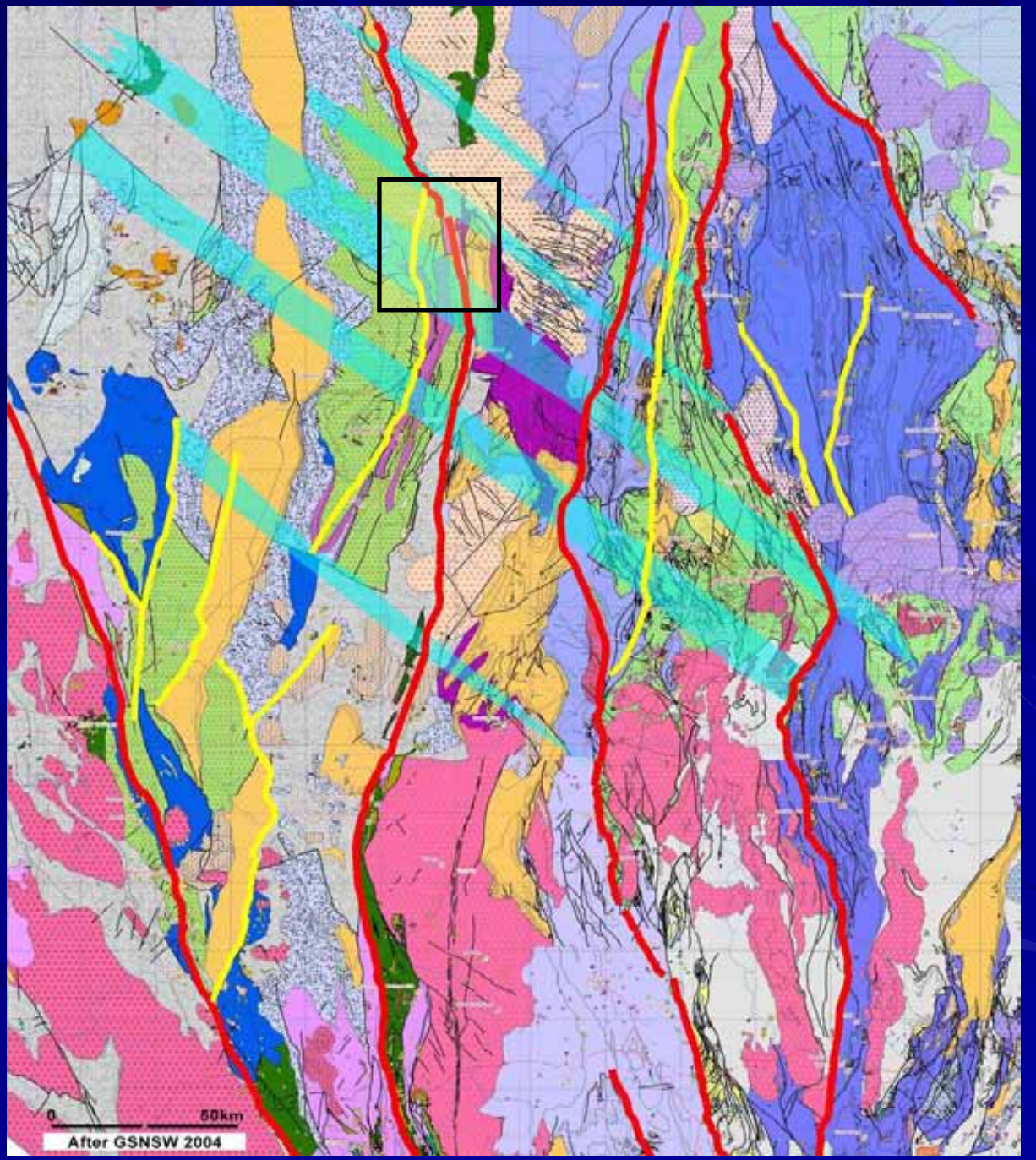
Historic Gold Production



Orogenic Gold Deposits

East Lachlan Geology

Tomingley Gold Project



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Orogenic Gold Deposits

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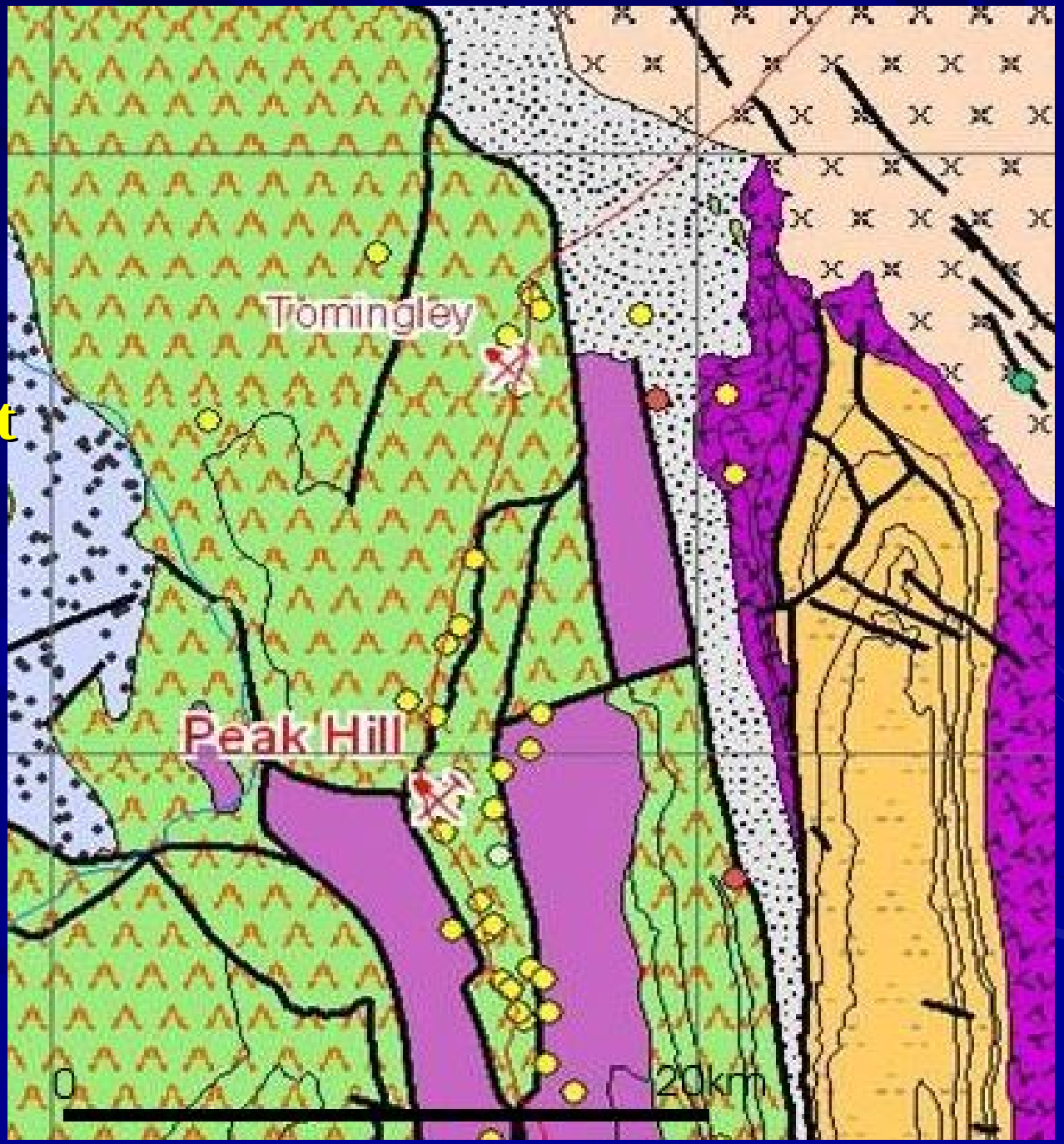
Regional Solid Geology and gold occurrences



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Orogenic Gold Deposits

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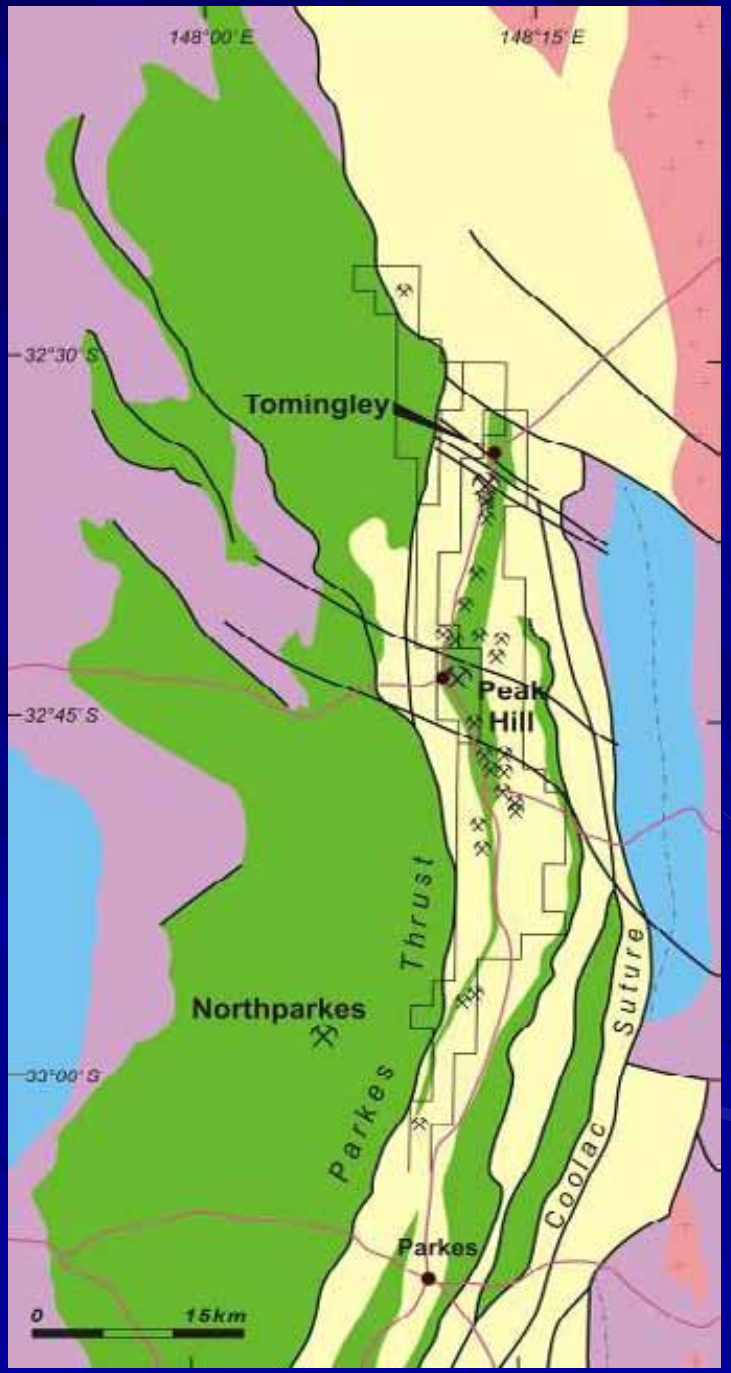
Regional Geological Interpretation

- Late Devonian sediments
- Early Devonian granites
- Late Silurian to Mid Devonian volcanics and sediments
- Ordovician to Silurian sediments
- Ordovician volcanic complexes



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Orogenic Gold Deposits

Tomingley Gold Project

Regional Geological Interpretation

Major structures

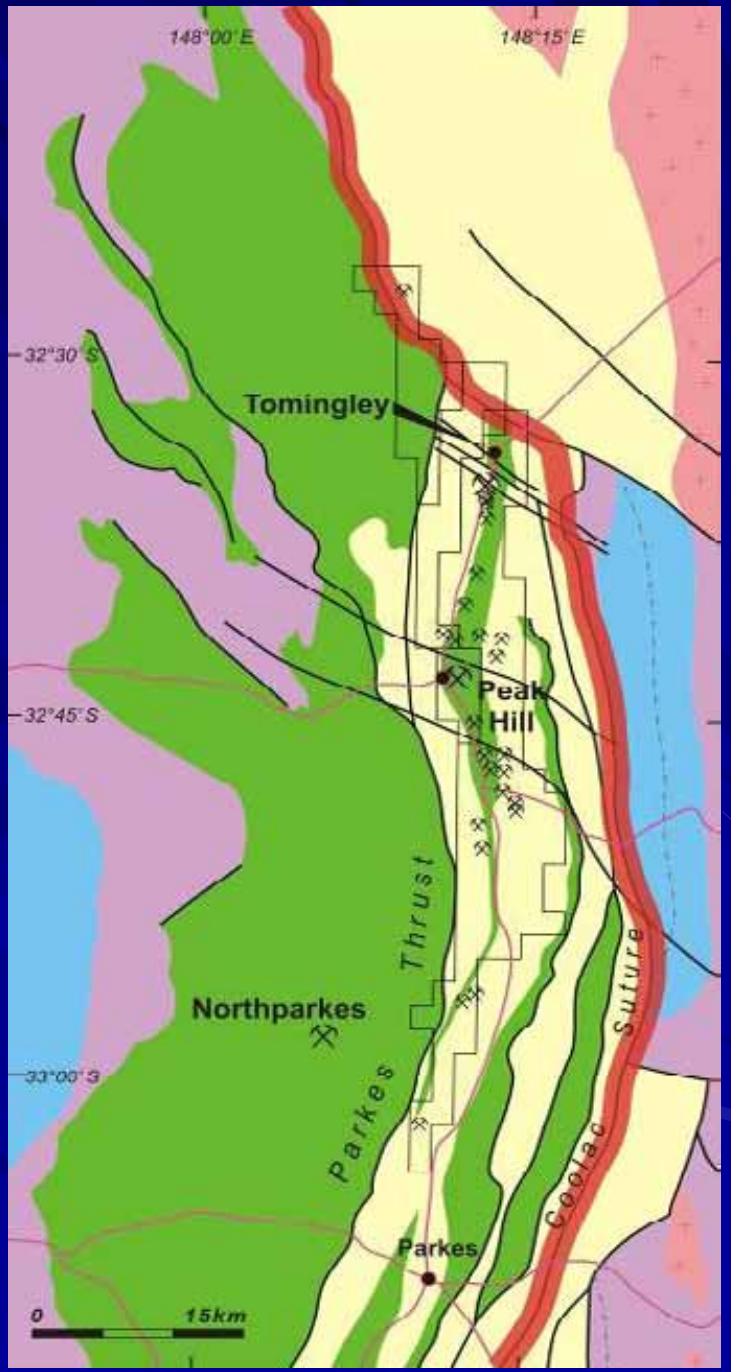
Late Devonian sediments

Early Devonian granites

Late Silurian to Mid Devonian volcanics and sediments

Ordovician to Silurian sediments

Ordovician volcanic complexes



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Orogenic Gold Deposits

Tomingley Gold Project

Regional Geological Interpretation

Second order structures

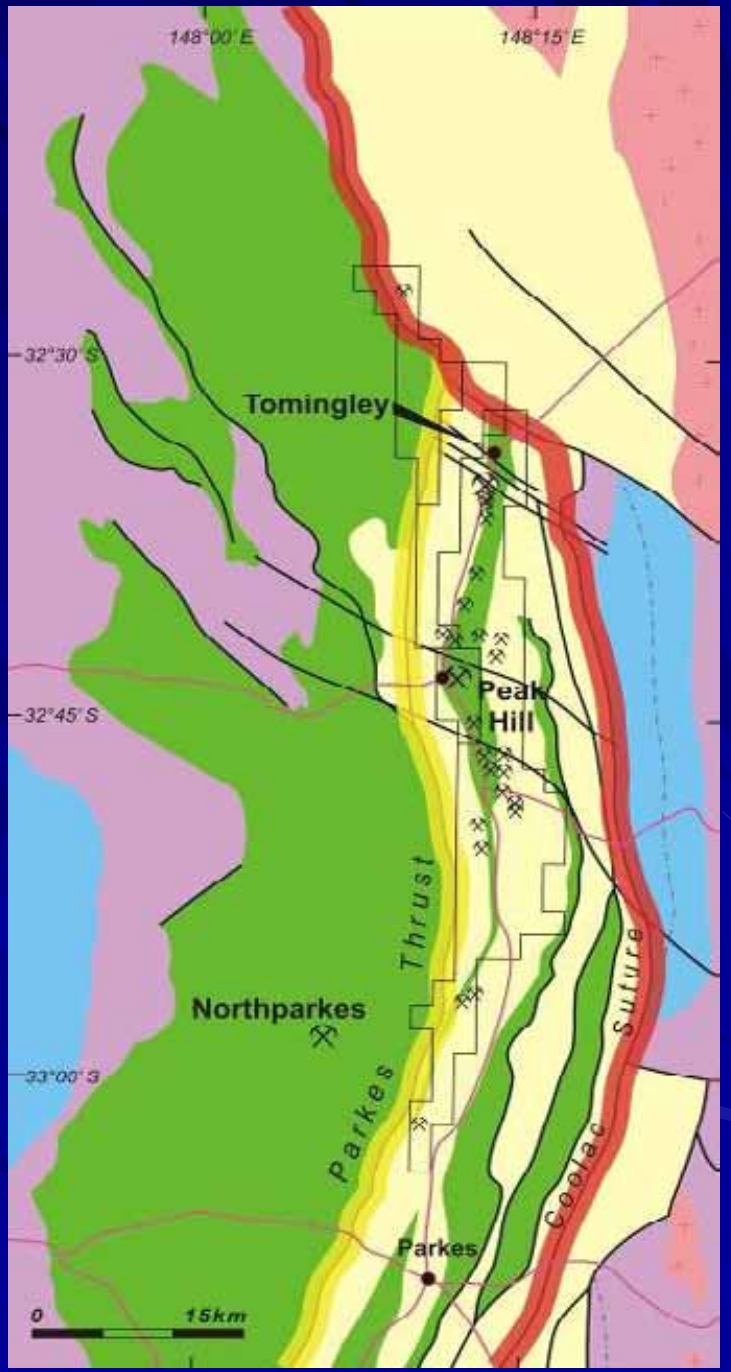
Late Devonian sediments

Early Devonian granites

Late Silurian to Mid Devonian volcanics and sediments

Ordovician to Silurian sediments

Ordovician volcanic complexes



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Orogenic Gold Deposits

Tomingley Gold Project

Regional Geological Interpretation

Third order structures

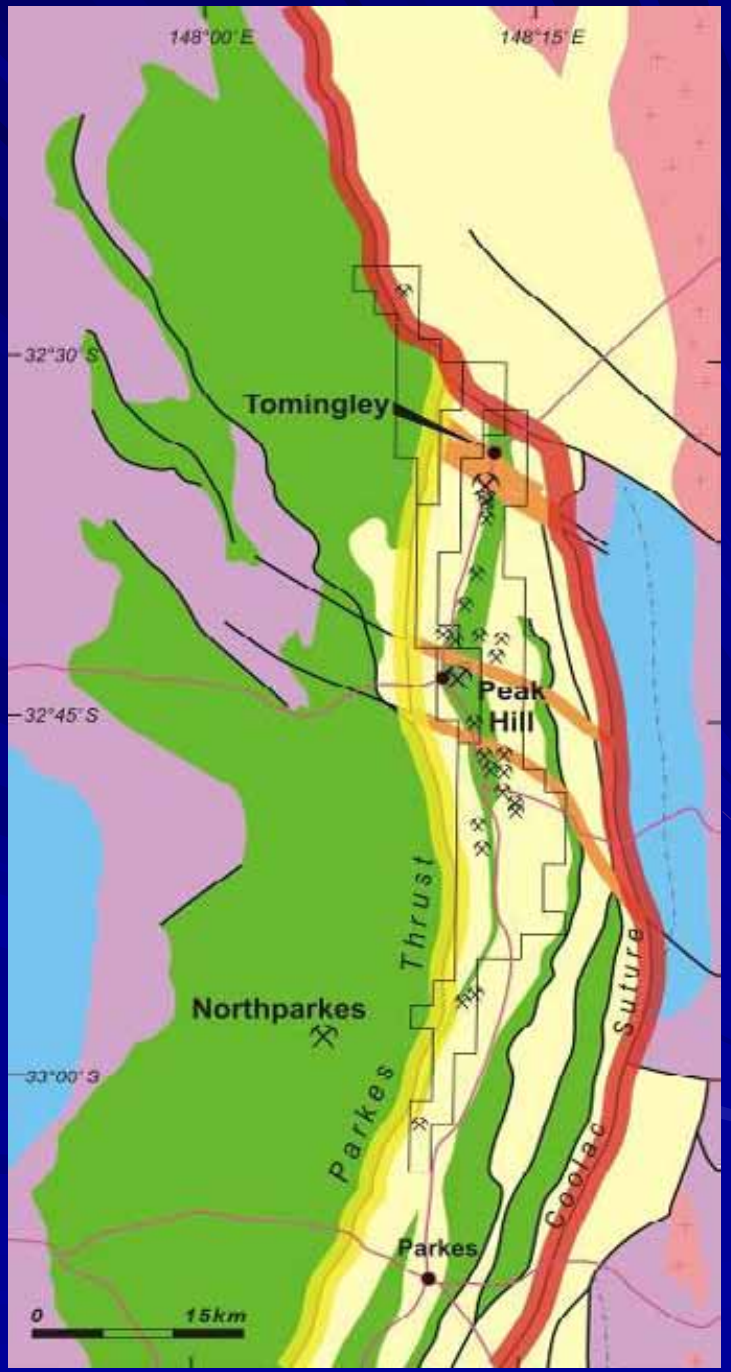
Late Devonian sediments

Early Devonian granites

Late Silurian to Mid Devonian volcanics and sediments

Ordovician to Silurian sediments

Ordovician volcanic complexes



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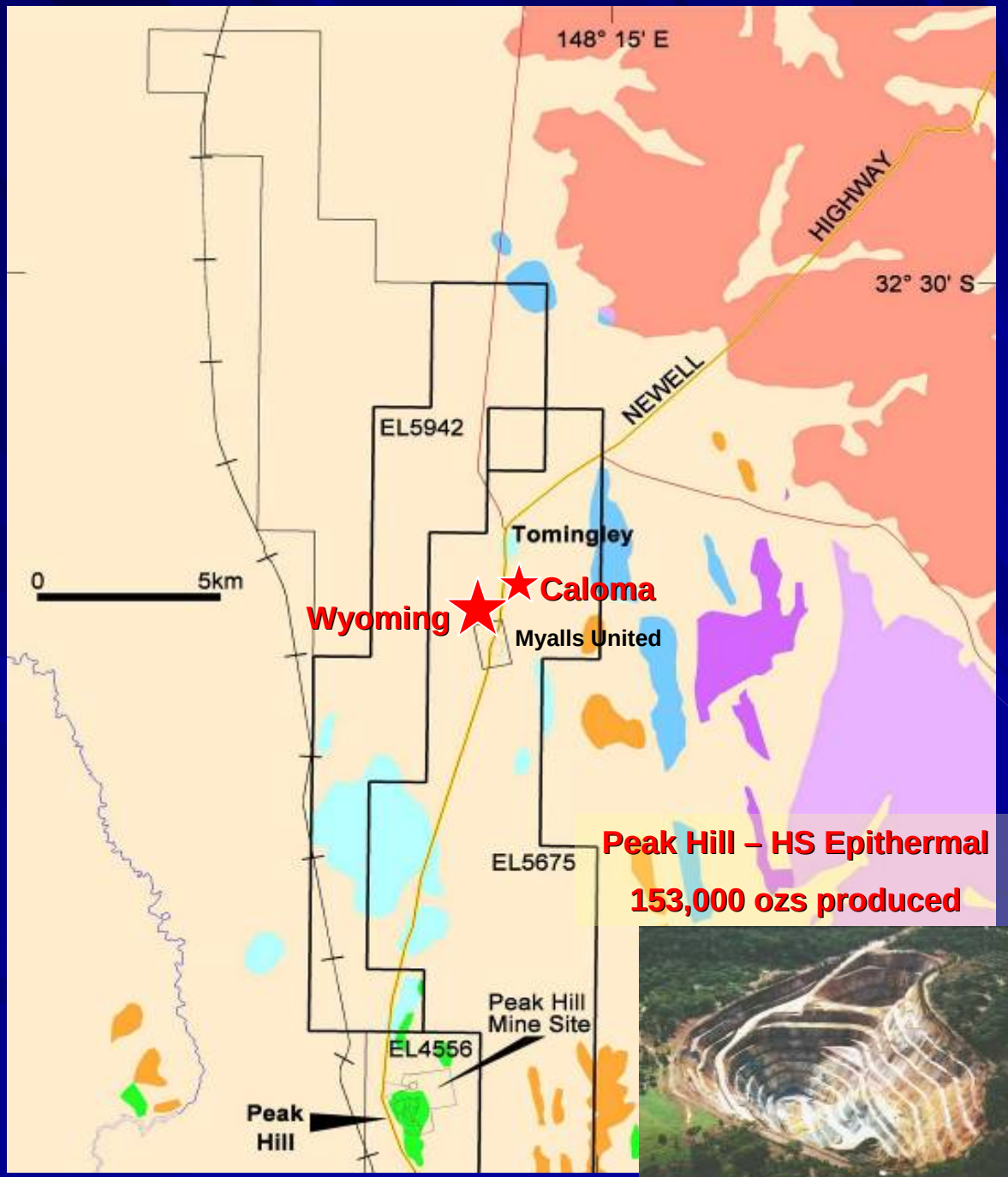
Regional Outcrop Geology

- Cover
- Hervey Group
- Dulladerry Rhyolite
- Yeoval Granite
- Forbes Group
- Mungincoble Chert
- Cotton Formation
- Goonumbla (Mingelo) Volcanics

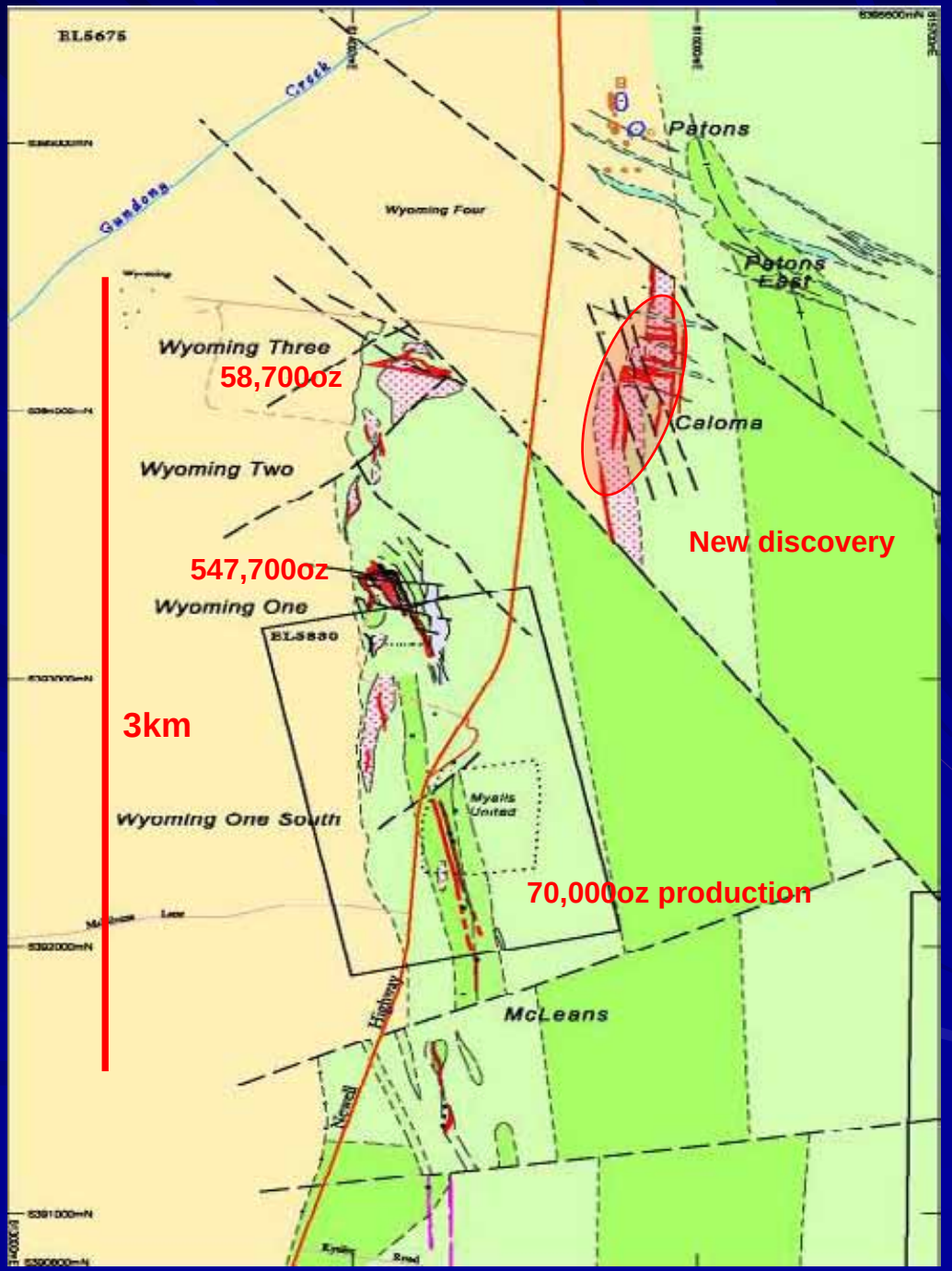


Tomingley Gold Project

Wyoming

Geological Summary

- Pelitic Sediments
- Feldspar porphyry
- Volcaniclastic sediments
- Graphitic mudstone
- Volcaniclastic conglomerate
- Epidote altered volcanics
- Chlorite-talc schist
- Andesitic volcanics
- Mineralisation

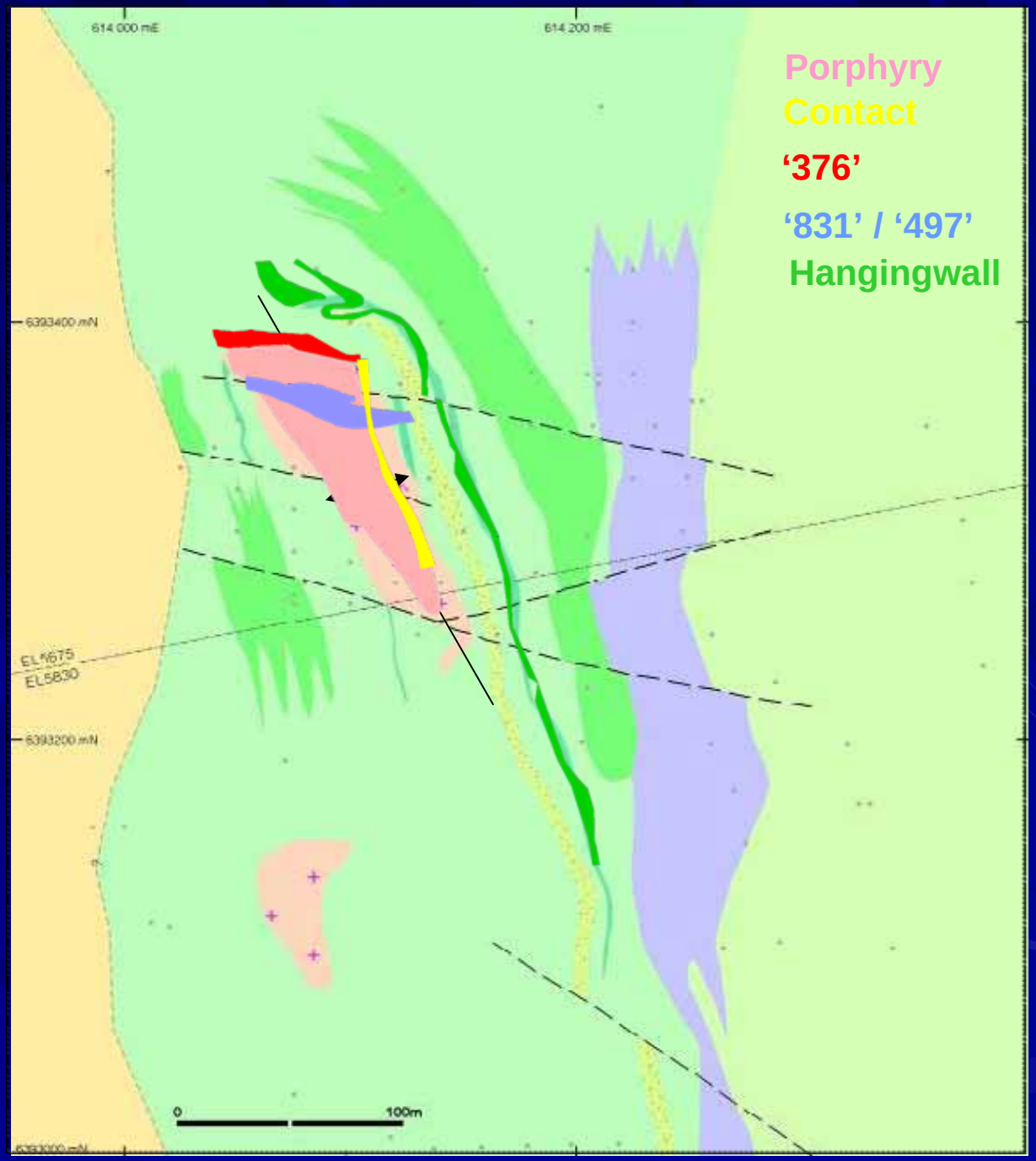


Tomingley Gold Project

Wyoming One

Geological Interpretation

- Pelitic Sediments
- Feldspar porphyry
- Volcaniclastic sediments
- Graphitic mudstone
- Volcaniclastic conglomerate
- Epidote altered volcanics
- Chlorite-talc schist
- Andesitic volcanics



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Tomingley Gold Project

Wyoming One

Alteration and Mineralisation Assemblage

- Pervasive: sericite - carbonate (ankerite) – albite - quartz
- Subordinate: chlorite – pyrite - arsenopyrite (up to 5% As)
- No apparent zoning
- Orogenic style alteration and mineralisation assemblage, suggests brittle to brittle-ductile environment

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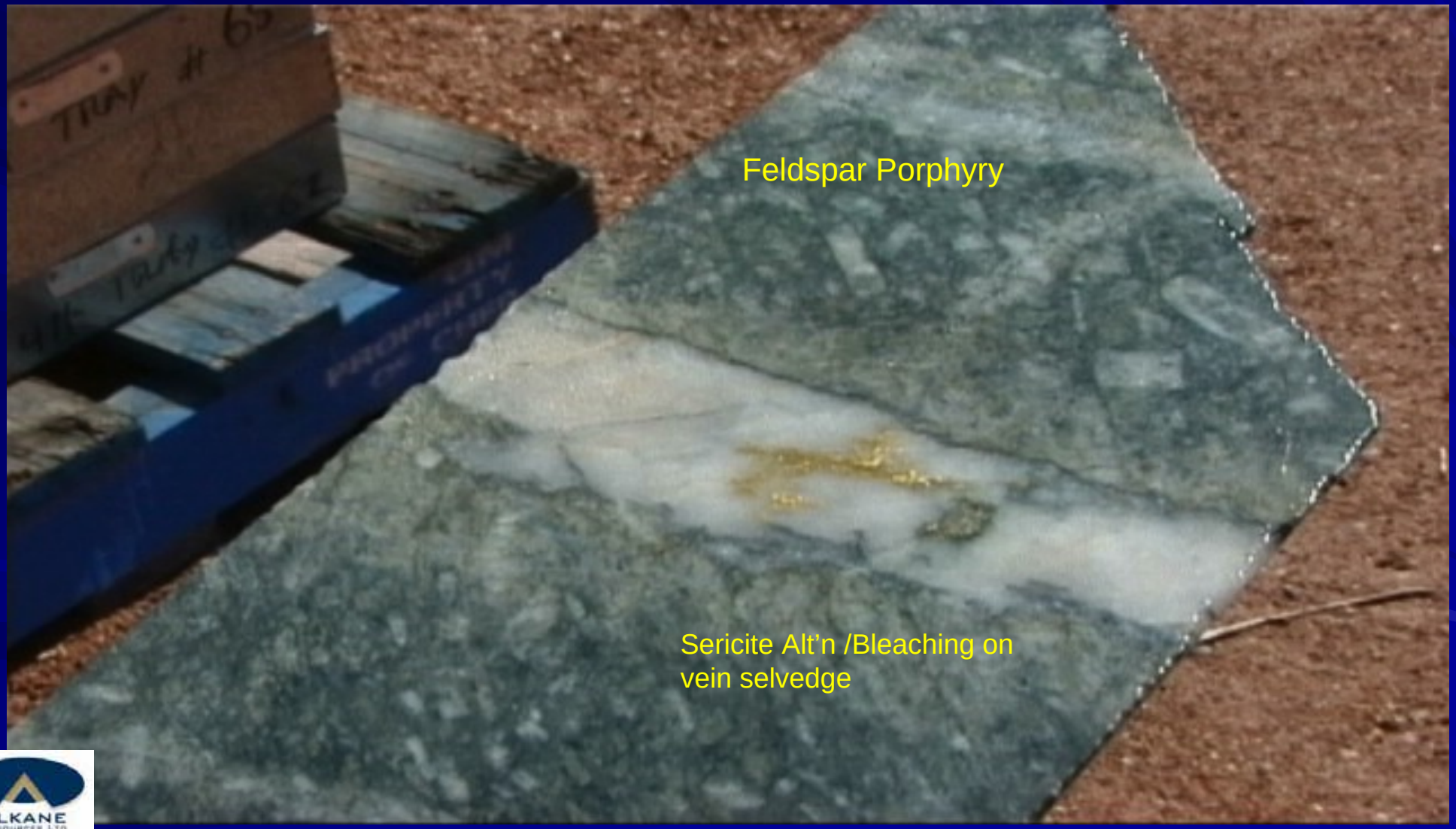
Tomingley Gold Project
Wyoming One Prospect
WY411 – Veining, Mineralisation and Vein Selvedge Alteration



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Wyoming One Prospect
WY791 – qtz-carb-ser-apy-py +/- chl "breccia" – '376' Zone

Tomingley Gold Project

Wyoming One Prospect

WY411 – qtz-carb-apy stockwork and chlorite spotting - HWZ

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Wyoming Prospect

Deformation History

- ENE – WSW contraction
  - Folding event
  - Some veining in porphyry?
- Rotation of stress field clockwise
  - ~ESE contraction may have formed fractures which later became faults which dissect porphyry
  - Veining in porphyry?
- Change to transpression
  - Movement on 376 structure and other faults which cross-cut porphyry
  - Major veining and mineralisation

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After Peter Schaubs *pmd*CRC*

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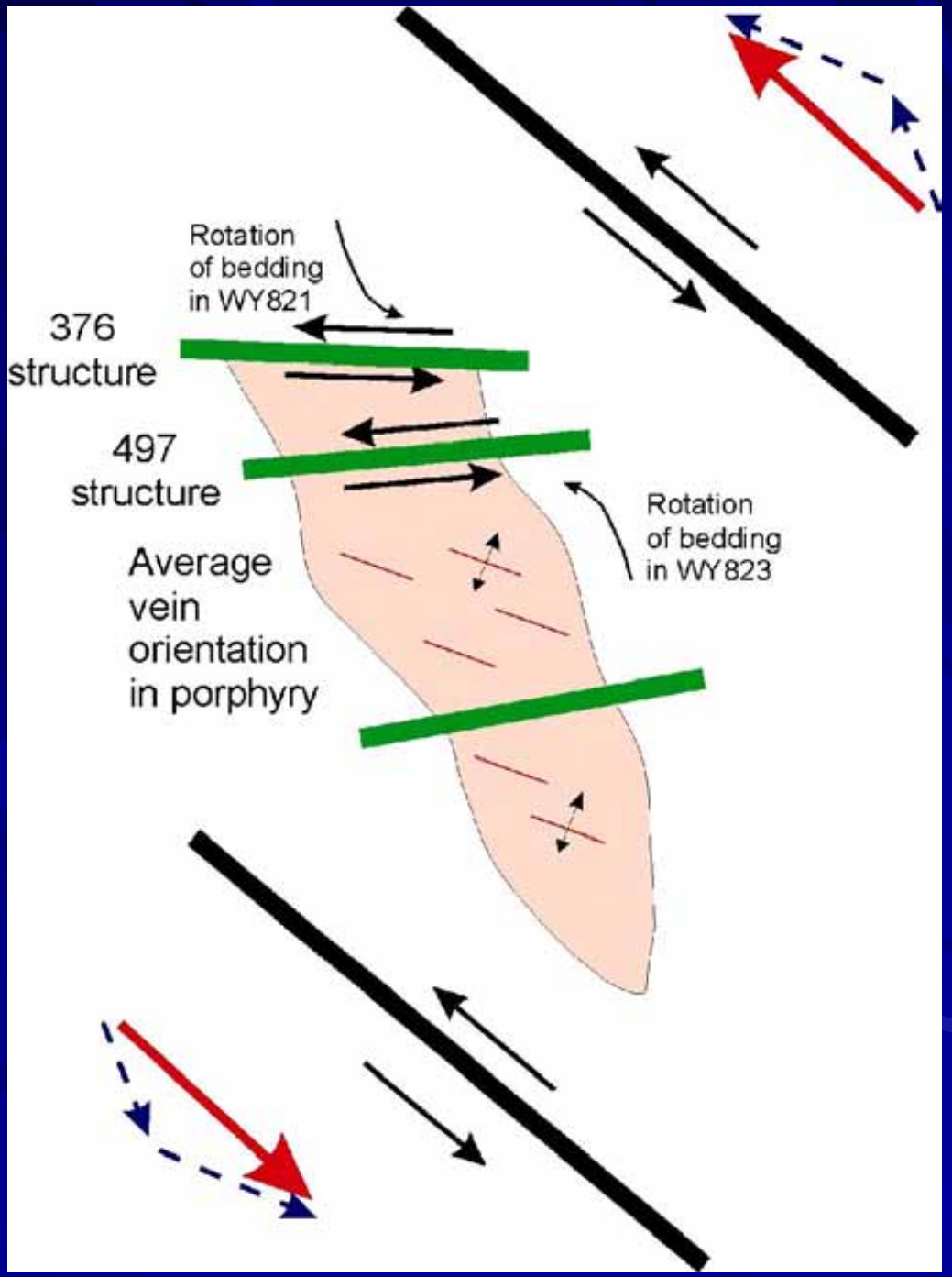
Wyoming One

Structural Interpretation

P Schaubs 2005 pmd.CRC



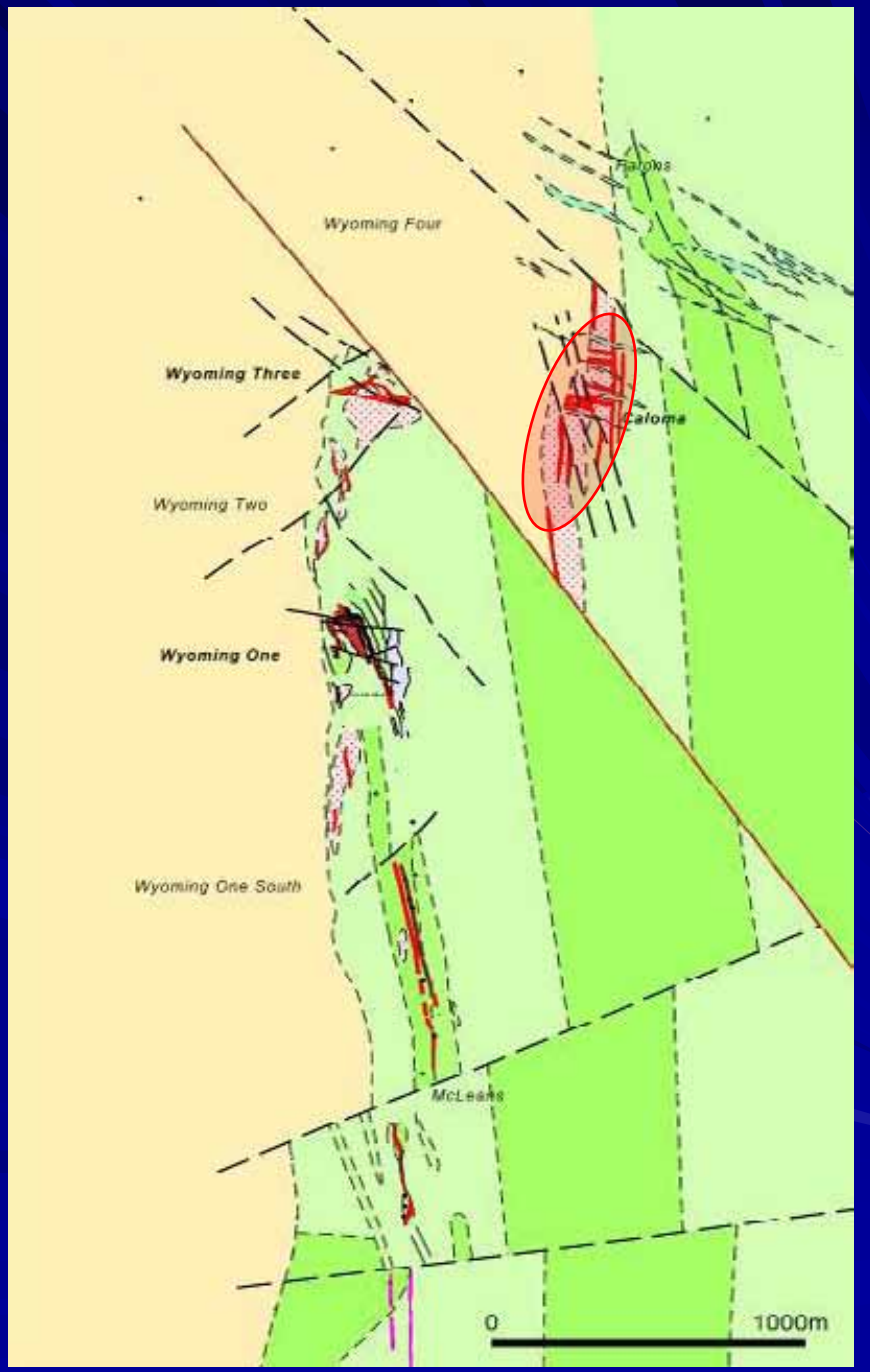
Tomingley Gold Project

Wyoming

Geological Summary

The Caloma Discovery

- Pelitic Sediments
- Feldspar porphyry
- Volcaniclastic sediments
- Graphitic mudstone
- Volcaniclastic conglomerate
- Epidote altered volcanics
- Chlorite-talc schist
- Andesitic volcanics
- Mineralisation



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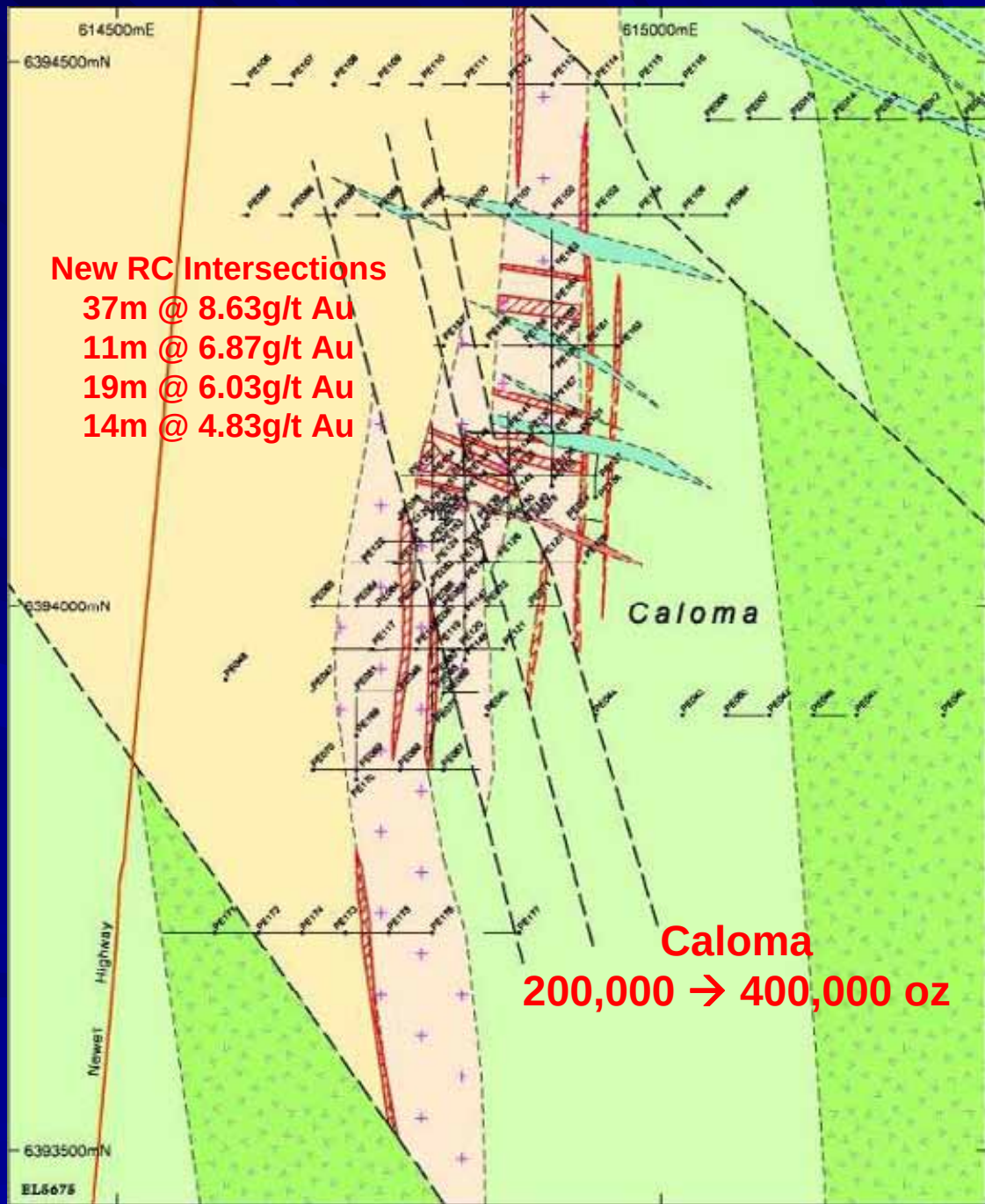
Tomingley Gold Project

Caloma

Preliminary
Geological Interpretation

- Pelitic Sediments
- Feldspar porphyry
- Volcaniclastic sediments
- Dolerite
- Volcaniclastic conglomerate
- Epidote altered volcanics
- Chlorite-talc schist
- Andesitic volcanics
- Mineralisation



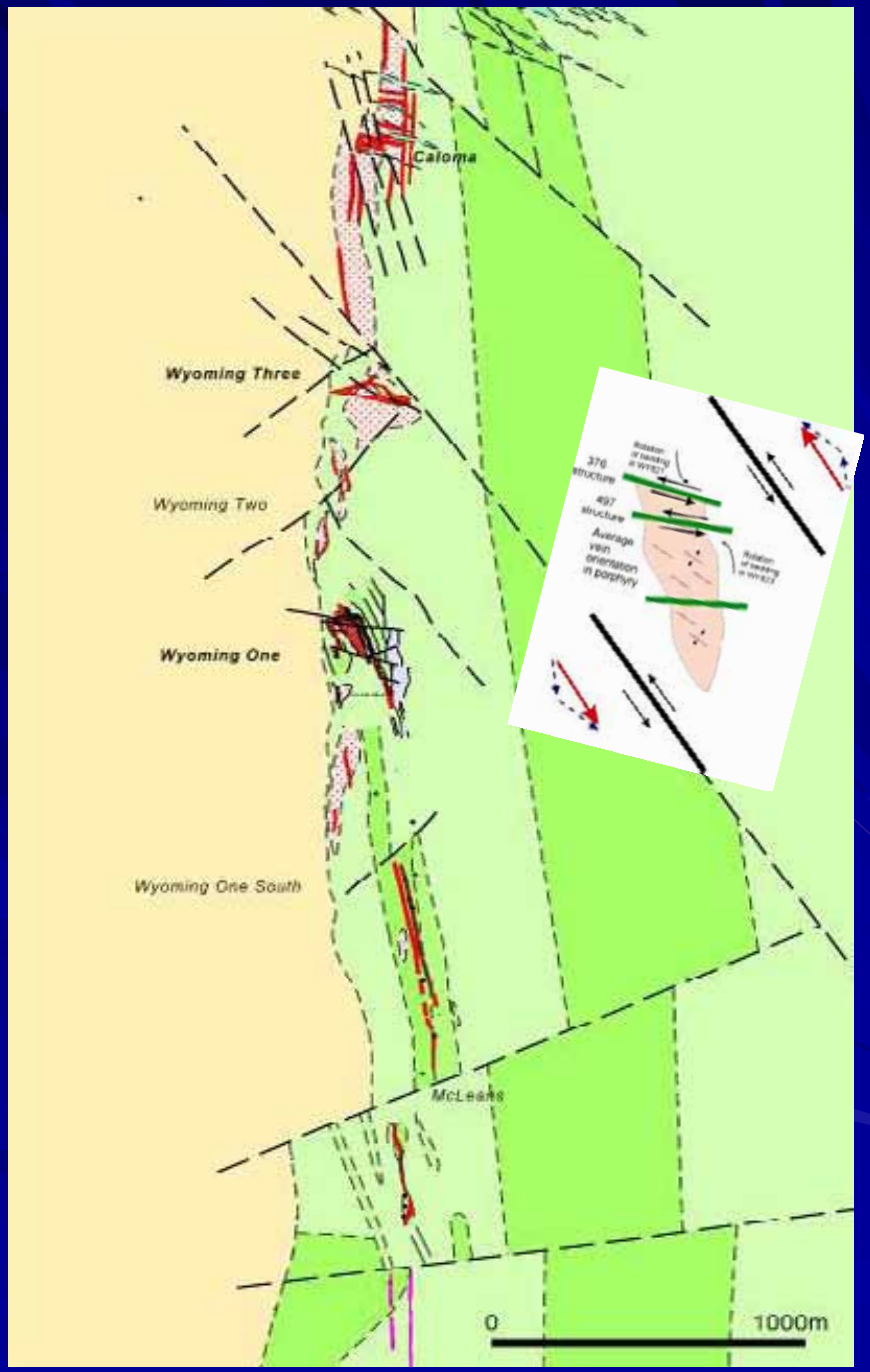
Tomingley Gold Project

Wyoming

Geological Summary

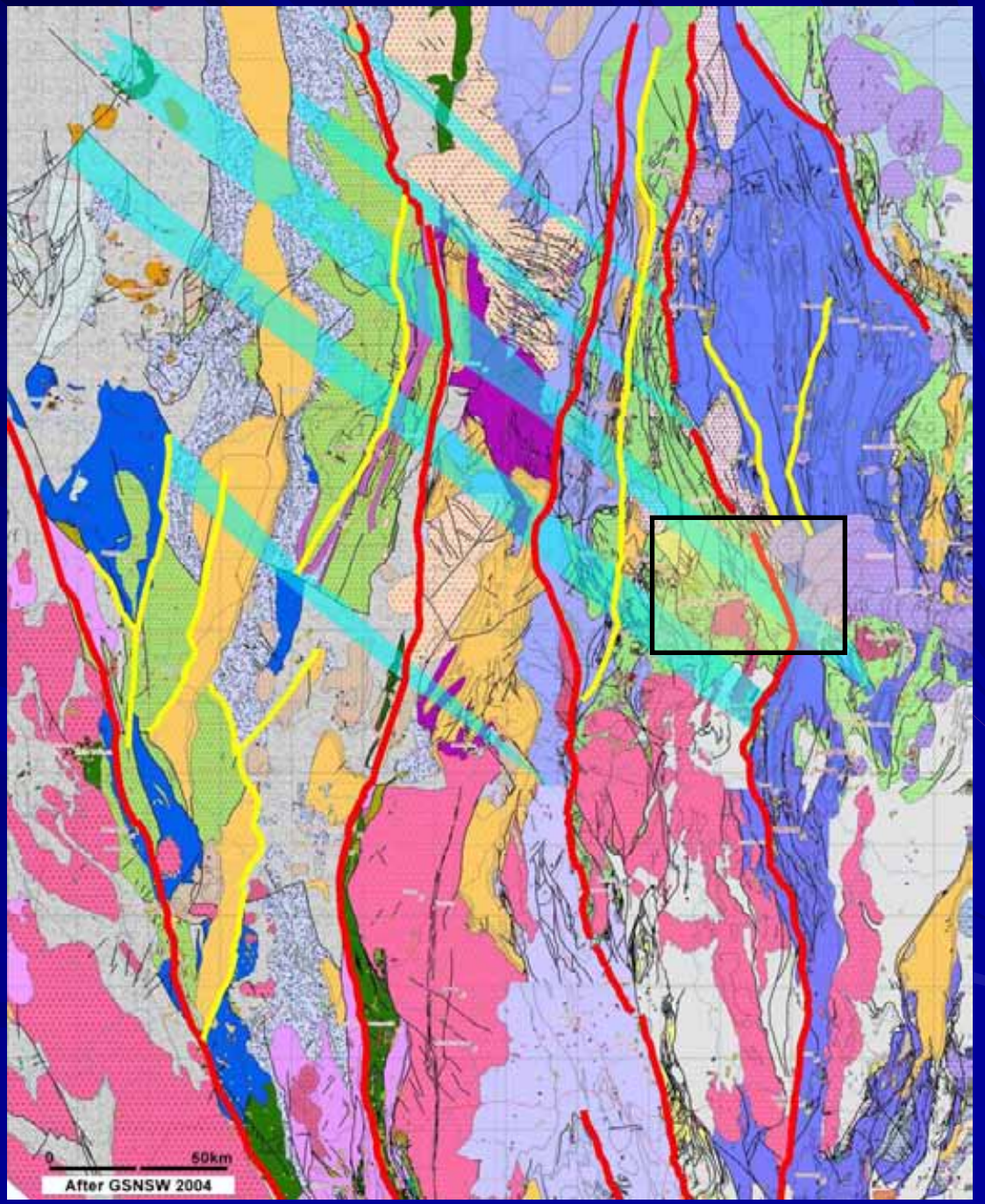
reconstructed fault movement

- Pelitic Sediments
- Feldspar porphyry
- Volcaniclastic sediments
- Graphitic mudstone
- Volcaniclastic conglomerate
- Epidote altered volcanics
- Chlorite-talc schist
- Andesitic volcanics
- Mineralisation



Orogenic Gold Deposits

East Lachlan Geology



Moorilda Project
ODEJV

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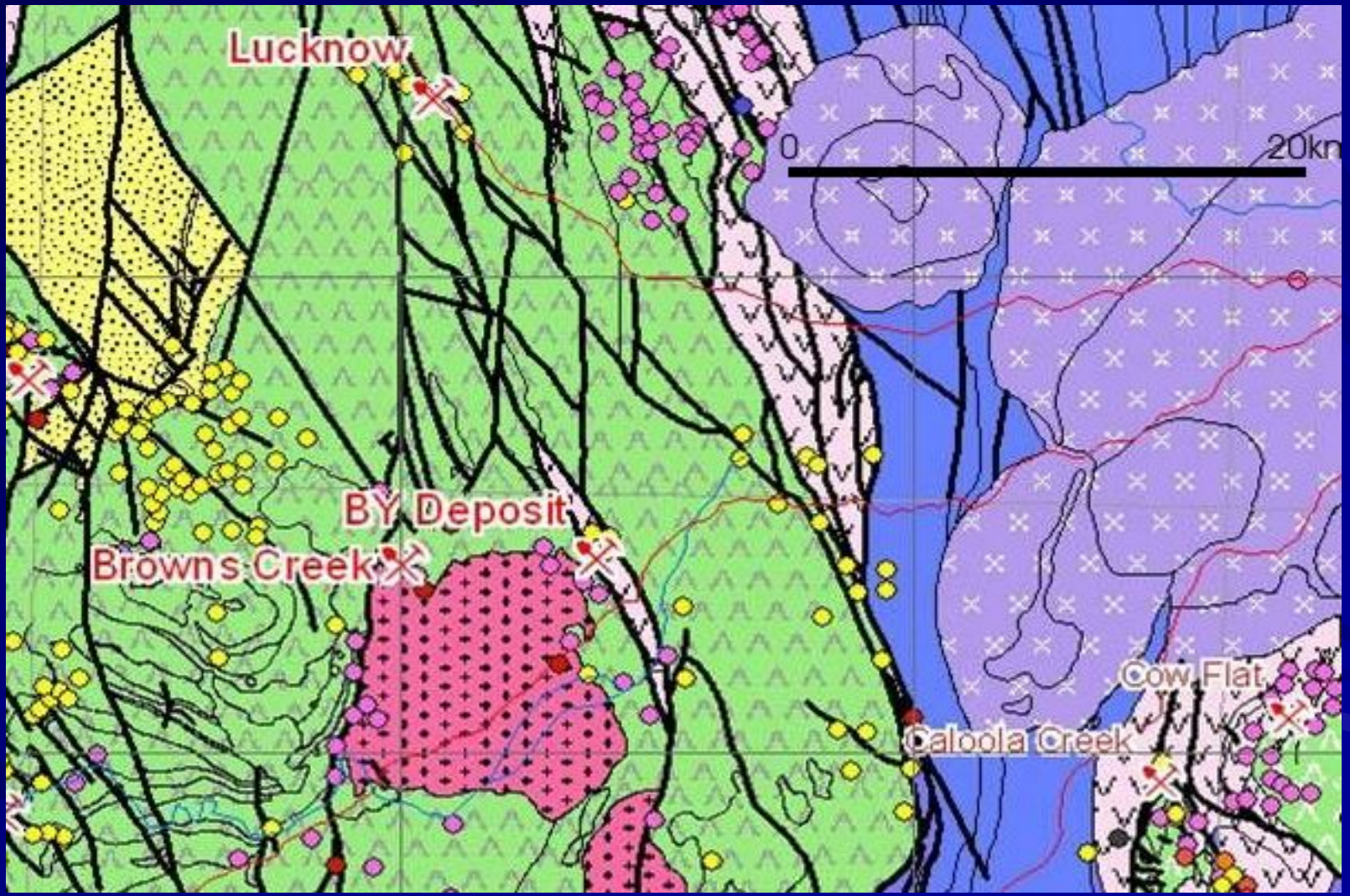
Orogenic Gold Deposits
ODEJV – Moorilda Project - McPhillamys



ODEJV
Moorilda

Geology and Prospects

Tertiary

Basalt

Carboniferous

Granite Intrusives

Devonian

Sediments & volcanics

Silurian

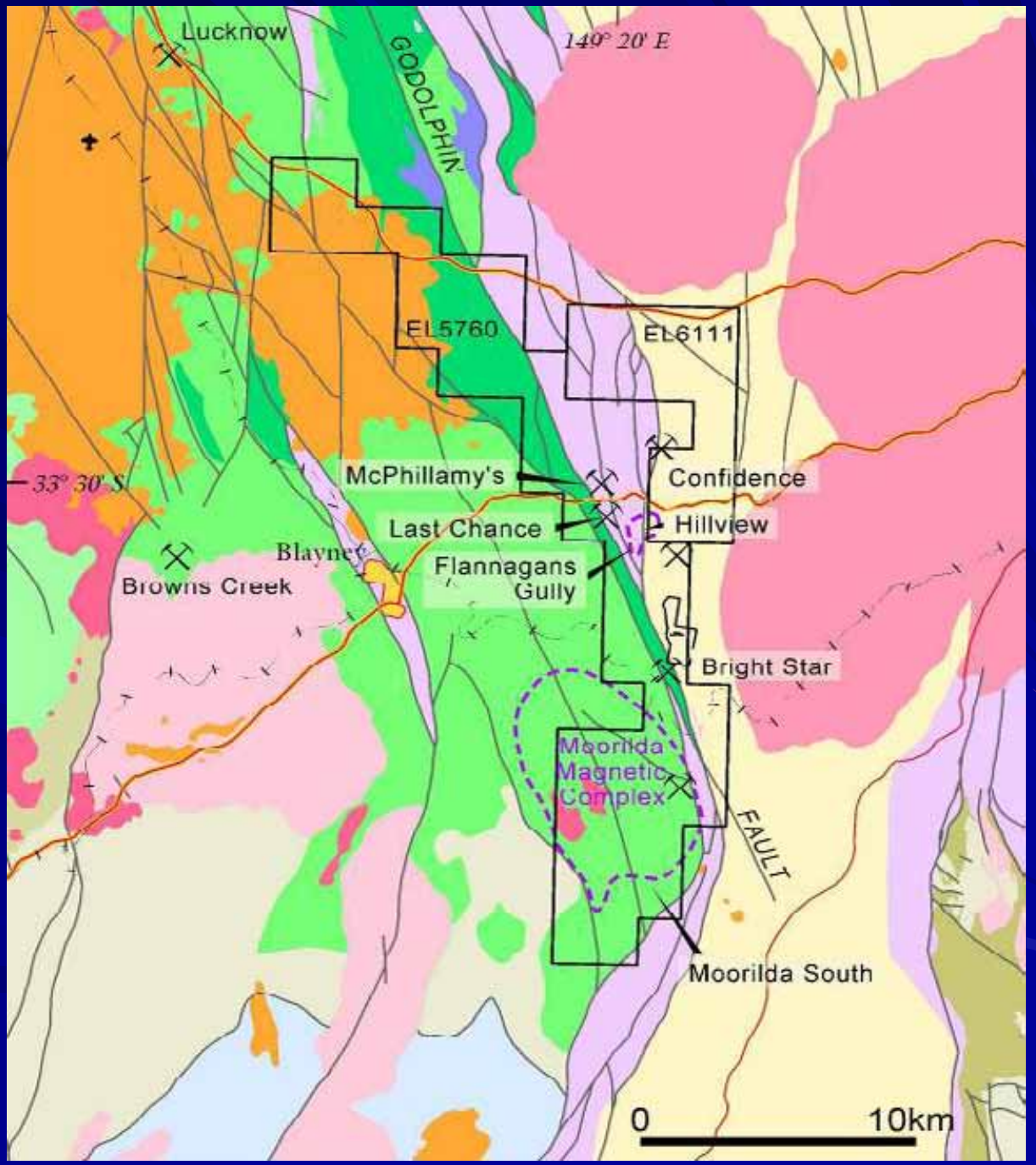
Volcanics

Ordovician

Intrusions – monzonite & syenite

Intrusions - ultramafic

Volcanics



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ODEJV
Moorilda
Geology and Prospect

Major structures

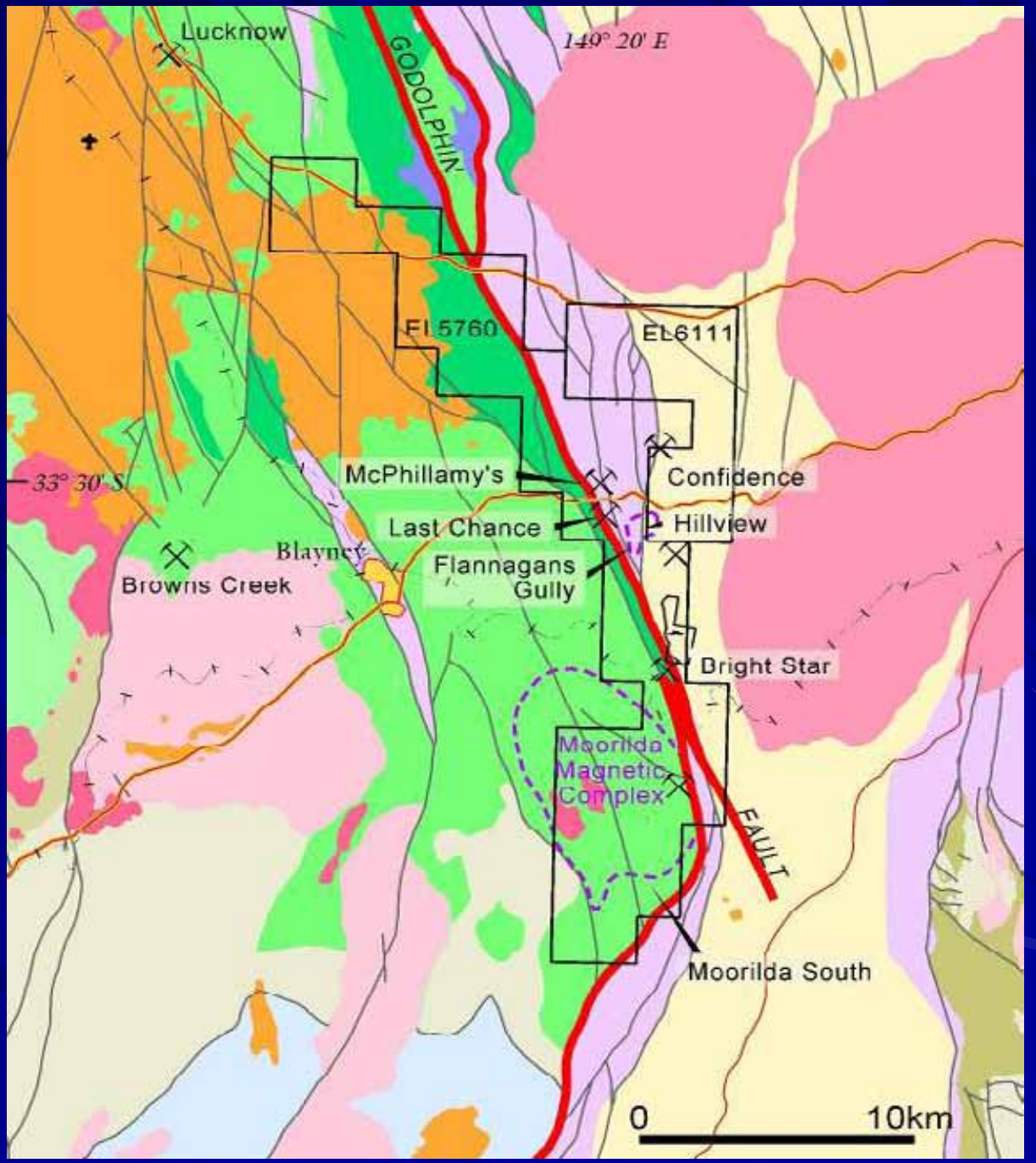
Tertiary
- Basalt

Carboniferous
- Granite Intrusives

Devonian
- Sediments & volcanics

Silurian
- Volcanics

Ordovician
- Intrusions – monzonite & syenite
- Intrusions - ultramafic
- Volcanics



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ODEJV
Moorilda
Geology and Prospects

Second order structures

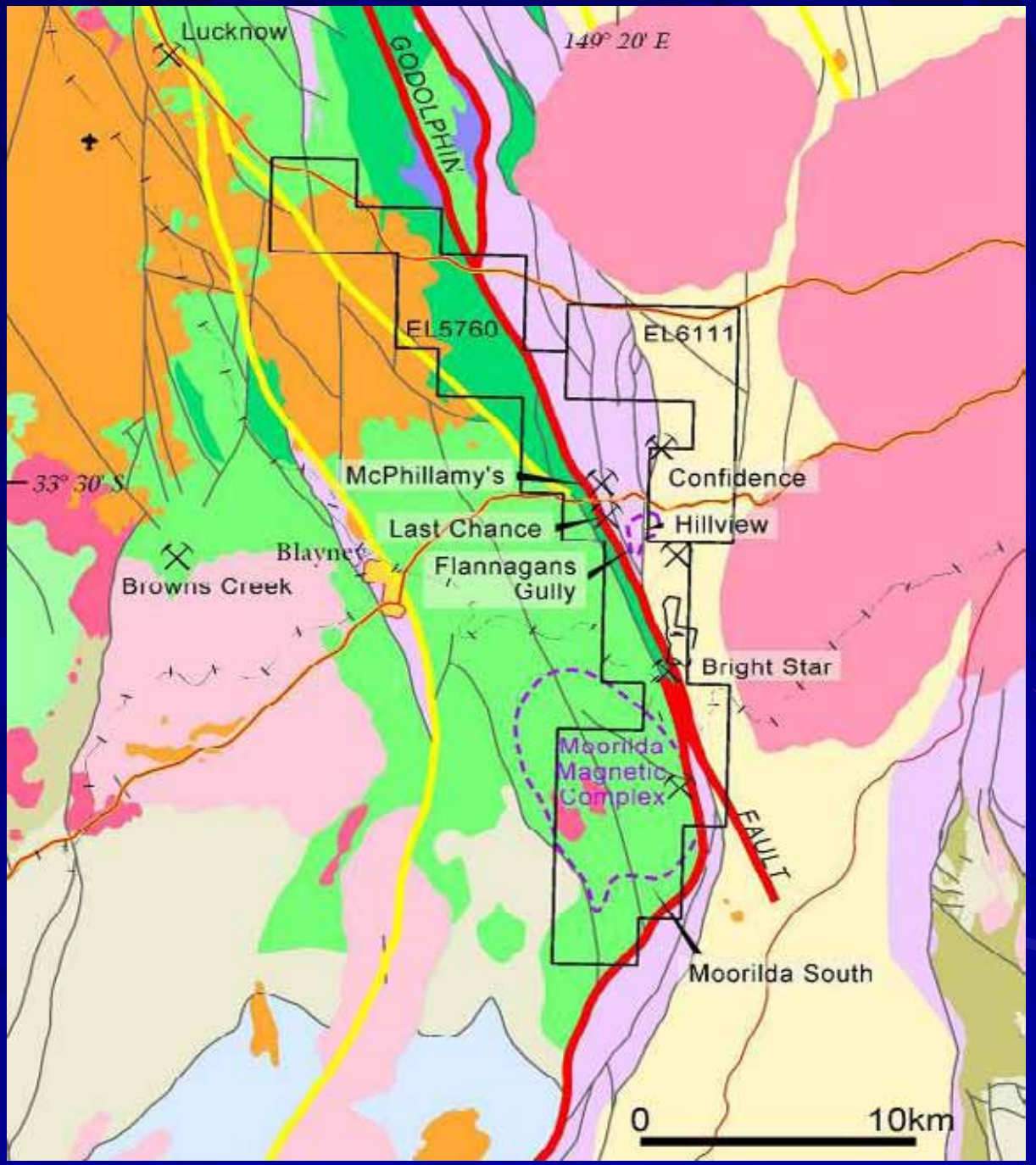
Tertiary
- Basalt

Carboniferous
- Granite Intrusives

Devonian
- Sediments & volcanics

Silurian
- Volcanics

Ordovician
- Intrusions – monzonite & syenite
- Intrusions - ultramafic
- Volcanics



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ODEJV
Moorilda
Geology and Prospects

Third order structures

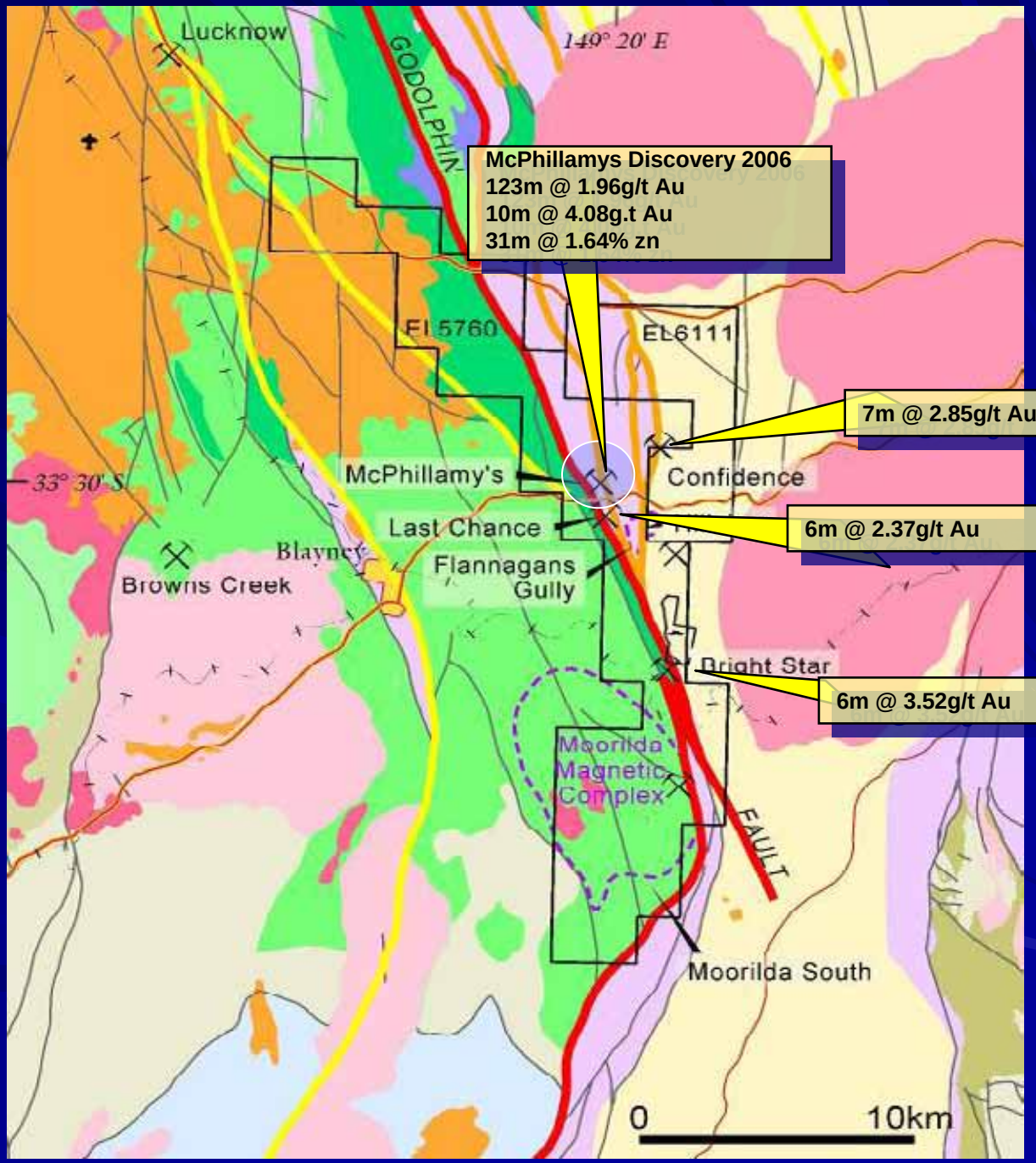
Tertiary
- Basalt

Carboniferous
- Granite Intrusives

Devonian
- Sediments & volcanics

Silurian
- Volcanics

Ordovician
- Intrusions – monzonite & syenite
- Intrusions - ultramafic
- Volcanics



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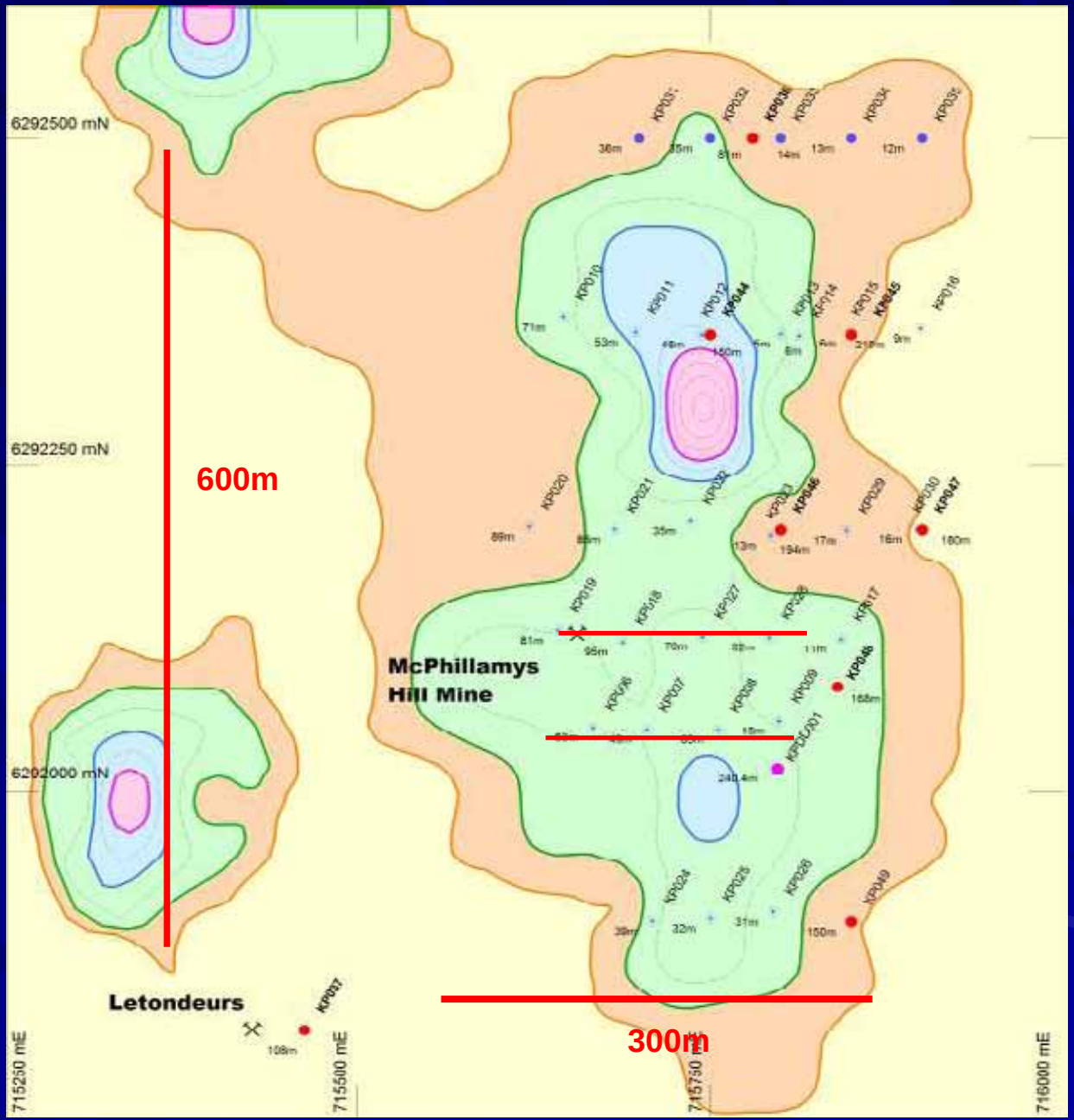
ODEJV
Moorilda

McPhillamys

Soil geochemistry with drill hole locations

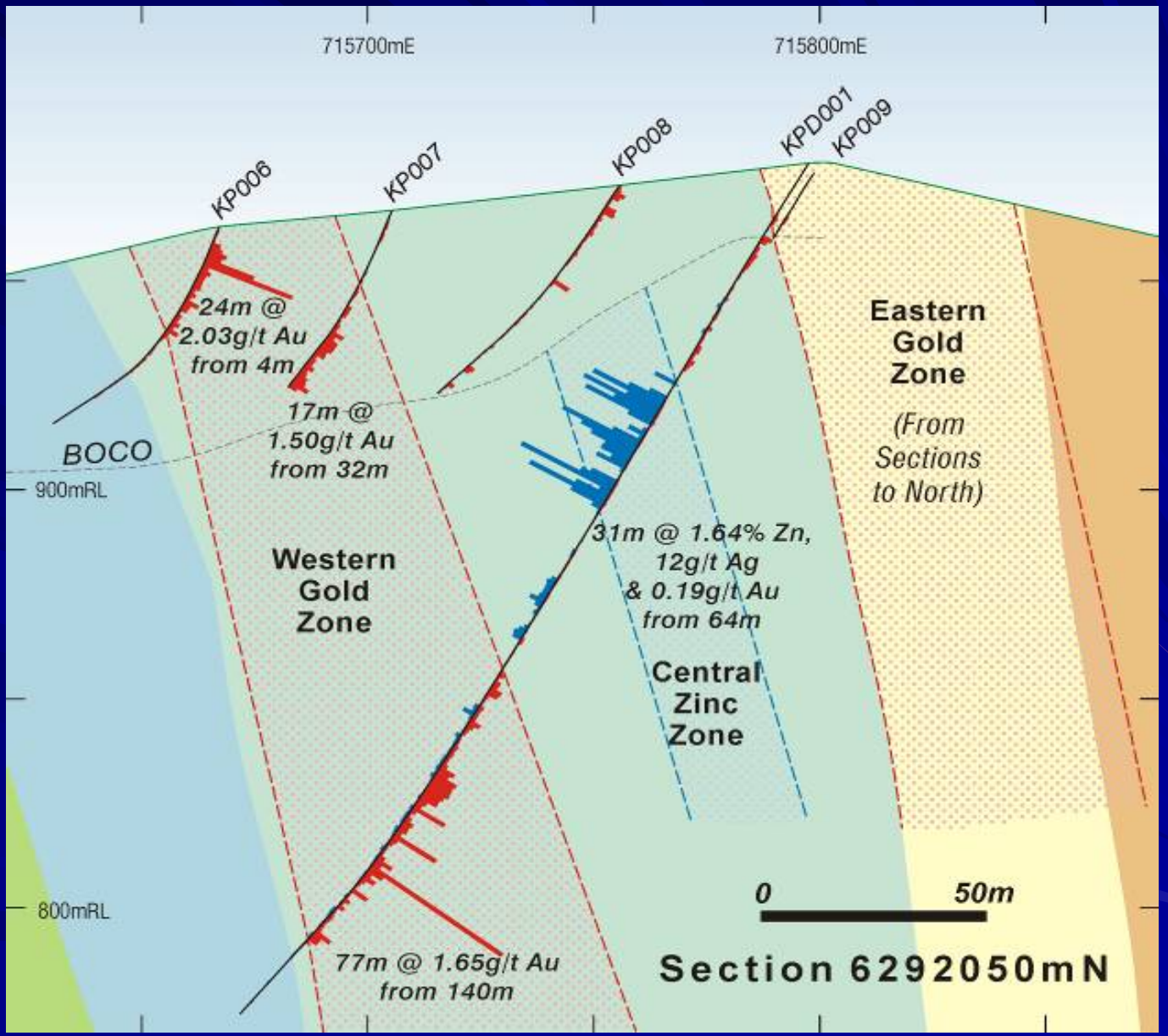


ODEJV
Moorilda
McPhillamys
Drill Section 6292050mN

Legend

- Sediments
- Western altered sediments
- Altered-sediments
- Felsic volcanic / volcaniclastic
- Volcaniclastic sediments
- Mineralised Zone - Au
- Mineralised Zone - Zn

>0.10% Zn >0.25 g/t Au



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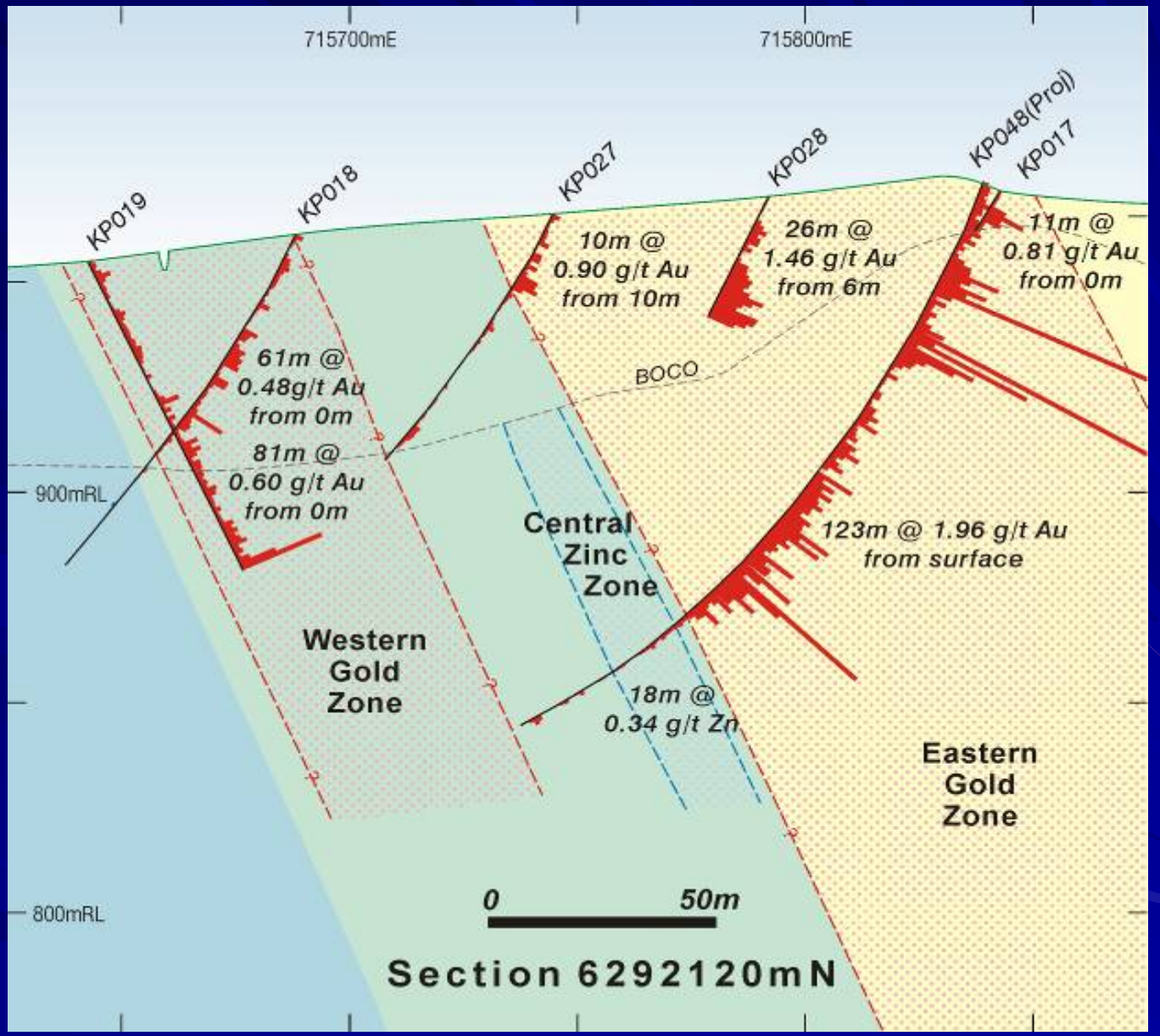
ODEJV
Moorilda
McPhillamys
Drill Section 6292120mN



Legend

- Sediments
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>0.10% Zn >0.25 g/t Au

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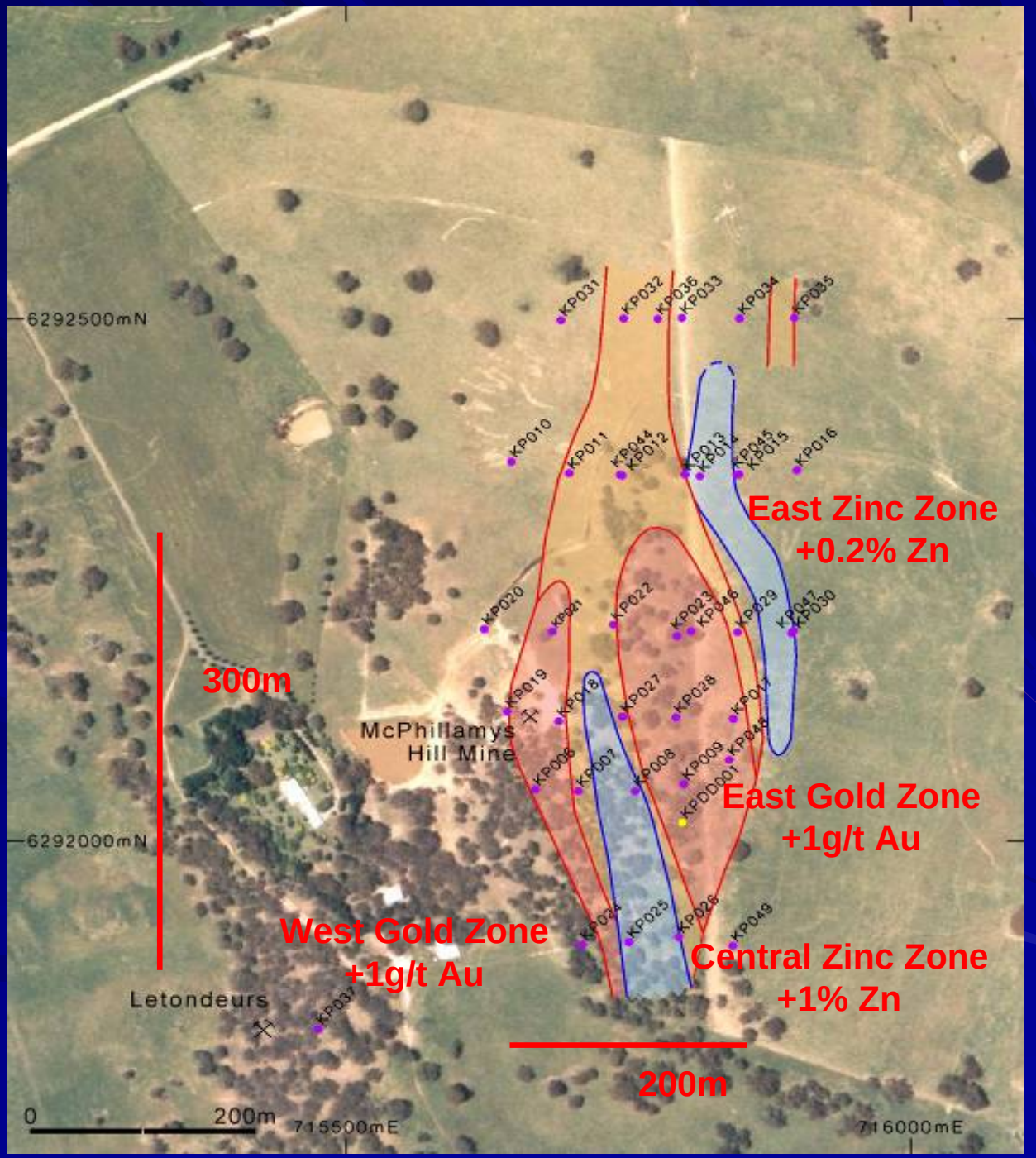
ODEJV
Moorilda

McPhillamys

Mineralisation with drill hole locations

Target potential > 1Moz



Moorilda ODEJV – McPhillamys Prospect

Ser – qtz - chl – py
+/- car – cpy – po
4 – 5g/t Au

Moorilda ODEJV – McPhillamys Prospect

Ser – qtz - chl – py -sph – ga – cpy
4 – 5% Zn

Moorilda ODEJV – McPhillamys Prospect

Alteration and Mineralisation Assemblage

- Host rocks – intermediate to felsic lavas, intrusives, epiclastic and tuff/sediments. Extensive shearing
- Pervasive: sericite – quartz – chlorite (biotite) – pyrite +/- pyrrhotite
- Sphalerite – galena – chalcopyrite: early to mid alteration; gold mid
- Later: sericite - chlorite – carbonate (Mg) → (Ca)
- Orogenic style alteration and mineralisation assemblage, suggests ductile to possibly ductile-brittle environment

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Orogenic Gold in the East Lachlan
SUMMARY
Yes there are world class deposits

- The historic production and the recent discoveries at Wyoming and McPhillamys demonstrates the potential exists
- We believe that the mineralising events at Wyoming are probably early Devonian age but hosted by andestic Ordovician rocks
- The McPhillamys mineralisation is within felsic to intermediate Silurian rocks but may also be of Devonian age
- The orogenic gold model can be applied to all rock types and ages in the region
- Exploration focus using all available techniques, but should not be “one model” driven
- The often complex geometry can lead to early disappointment but persistence and understanding does pay off

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Orogenic Gold Deposits in the East Lachlan

ACKNOWLEDGEMENTS

Rimas Kairaitis
Justin Tolman

Peter Schaubs
Tony Crawford
Rick Squire

MINES AND WINES

ORANGE
20-21 September 2007

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